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Biodiversity of Cockroaches from houses of Quetta city, Balochistan

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Abstract

Total 249 cockroaches were collected from four zones of Quetta city and which were further classified into five species under three families of Blattodea. The most common species with abundance of 31% was *Periplaneta americana* followed by *Blatta orientalis* (22%), *Blattella germanica* (22%), *Blattala teralis* (17%) and *Polyphaga aegyptiaca* (8%). The zone wise distribution results of cockroach's species revealed that east zone (31%) of Quetta city was more affect as compared to other zones. *Periplaneta americana* was most dominant in west (9%) and north (9%) zones while least abundant in east (6%) zone. The highest percentage of *Periplaneta americana* was recorded in car porch (8%) of houses. *Blatta orientalis* was second the most abundant cockroach and was most dominant in west (7%) zone while highest percentage was observed in car porch (9%) and galleries (8%) of houses. *Blatta lateralis* was most dominant in east (8%) zone while in houses highest percentage was found in kitchen (10%). *Blattella germanica* was most dominant in east (10%) zone while highest percentage was recorded (14%) in kitchen and store rooms (8%). *Polyphaga aegyptiaca* was least abundant as compared to other recorded species of Quetta city. The *Polyphaga aegyptiaca* was most dominant in north (4%) zone while highest percentage (7%) in car porch and least was recorded in house floor (1%). There was no scientific work done on the cockroaches in Balochistan specifically in Quetta region, this present research identifies the local cockroach's species, so as to fill partially the research gap that exists in the field of taxonomy of Blattodea.

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Introduction

The insects cover the large portion of live fauna and play important role in ecosystem (Samways, 2005). Cockroaches belong to the kingdom animalia, phylum arthropoda and order Blattodea (Sayyadi *et al*., 2014). Cockroaches are also known as terrestrial Blattids because they are distributed in tropical and subtropical regions of the world; there are 5000 species have been reported in worldwide (Beccaloni and Eggleton, 2013). Cockroaches have an oval and flattened shape, long antennae and having two pairs of wings folded flat over their back. The color of cockroaches generally varies from light brown to black. The species size varies from 2 mm to more than 80 mm in length (Thomazini and Thomazini, 2000), and their antennae extending from the head that are equally as long as their whole body. Male cockroaches have an additional set of appendages called styli on their abdomens. It is located between the cerci, it's smaller and more delicate in appearance. The presence of styli is the easiest way to differentiate between male and female cockroaches. Usually cockroaches have wings and occasionally fly, when they disturbed they are preferring to run and awkwardly fly (Rust *et al*., 1995).

Cockroaches have three stages, which are the egg, nymph, and adult (Baumholtz *et al*., 1997). The female cockroaches can deposit their eggs in groups and the egg case is bean like shaped also called as ootheca (Rust *et al*., 1995). Ootheca contains approximately up to 16-20 eggs it depends upon species (Robinson, 2005). Some species like *Blattella germanica* (German cockroaches) they carry their ootheca for several weeks attached to the end of their body but most other species the ootheca attached only for one or two days but it depends upon species, temperature and humidity. The eggs hatch after 1 to 3 months (Rust *et al*., 1995). Cockroaches molt and shed their exoskeleton in order to grow (Baumholtz *et al*., 1997). Many adult cockroaches have fully developed wings, whereas other cockroaches have short wings or lack wings altogether. Young, immature cockroaches resemble adults but are smaller and wingless (Hashemi-Aghdam and Oshaghi, 2015).

An immature cockroach species can be surviving approximately ten days without food where as adults can be surviving up to 6 weeks (Baumholtz *et al*., 1997). Many adult cockroaches have fully developed wings, whereas other cockroaches have short wings or lack wings altogether. Young, immature cockroaches resemble adults but are smaller and wingless (Hashemi-Aghdam and Oshaghi, 2015).

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Cockroaches play an important role in recycling of decaying plant materials in forest ecosystem (David and Ananthakrishnan, 2004). They are extremely important in many food chains and they are food for carnivores such as birds, lizards, rats and other small mammals. The majorities of cockroach species approximately more than 99% live in the wild areas and playing an important role in the forest eco-system (Bhoopathy, 1997).

On the basis of morphology, Cockroaches can be easily identified and classified in different region of the world. In Pakistan there was no studies was done. As there was no scientific work done on the cockroaches in Balochistan specifically in Quetta region, this study was conducted to identify the local cockroach species, so as to fill partially the research gap that exists in the field of taxonomy of Blattodea. This paper reveals that the diversity of Cockroaches in Quetta city of Balochistan.

Materials and methods

Study description

The study was conducted in center for advanced studies in vaccinology and biotechnology (CASVAB) university of Balochistan, Quetta.

Sample collection

A total 249 randomly cockroaches were collected form the 4 different zones of Quetta city. Cockroaches were collected from different localities of houses by direct hand catching with sterile gloves from store rooms, bedrooms, kitchen, washrooms, car porch courtyard, gardens and galleries from different houses of Quetta city.

Identification of cockroaches

Identification was done by examining the cockroaches and sex identification was done under a low power microscope.

The morphological characteristics and taxonomic keys were also used for identification (Chew *et al*., 2006). Cockroaches were identified by the following taxonomic features: color, number and the shape of spines on the femora, tarsus, wings, reproductive organs, and head frontal (Hashemi-Aghdam and Oshaghi, 2015).

Results

A total of 249 random individuals of cockroaches were collected from 4 zones of Quetta city which were classified into five species under 3 families of Blattodea as shown in Table 1. Identification of the species were done on the basis of their morphology: body color, size, antennae, cercus presence or absence of stylus.

Blattidae was the most abundant family with abundance of 70% while *Periplaneta americana* (American cockroaches) was recorded the most abundant with a frequency of 31%.

Periplaneta americana was most dominant in west and north zones and least abundant in east zone (Table 1). *Periplaneta americana* was collected from different localities of houses with the highest percentage (8%) was recorded in car porch while least was recorded in wall cracks and store room (1%) (Table 2).

Blatta orientalis (Oriental cockroaches) was recorded second the most abundant with a frequency of 22%. *Blatta orientalis* was most dominant in west (7%) and south (6%) zones while least was found in east and north zones (Table 1). *Blatta orientalis* was recorded with highest percentage (9%) in car porch while least was recorded in garden (1%) of different houses (Table 2).

Blatta lateralis (Turkestan cockroaches) was recorded third the most abundant of Blattellidae family with the frequency of 17%. *Blatta lateralis* was most dominant in east (8%) zone while least recorded in north, west and south zones (Table 1). *Blatta lateralis* was recorded with highest percentage (10%) in kitchen while least was recorded in store rooms (2%) of houses (Table 2).

Table 1. A list of the cockroach's species identified from different zones of Quetta city.

No	Families	Species	Common Names	No. of individuals collected per zone				Total % Frequency	Abundance
				East	West	North	South		
1	Blattidae	*Periplaneta americana*	American cockroaches	6%	9%	9%	7%	31%	70%
		Blatta orientalis	Oriental cockroaches	5%	7%	4%	6%	22%	
		Blatta Lateralis	Turkestan cockroaches	8%	3%	3%	3%	17%	
2	Corydiidae (Polyphagidae)	*Polyphaga aegyptiaca*	Egyptian desert cockroach	2%	1%	4%	1%	8%	8%
3	Blattellidae	*Blattella germanica*	German cockroaches	10%	4%	3%	5%	22%	22%
Total	3	5	5	31%	24%	23%	22%	100%	100%

Table 2. Collection of Cockroach species from different location of houses at Quetta city.

No	Species	Indoor Collection areas									
		Kitchen	House floor	Bedrooms	Store rooms	Garden	Wash rooms	Wall cracks	Galleries	Car porch	Total
1	*Periplaneta americana*	3%	4%	3%	1%	2%	6%	1%	3%	8%	31%
2	*Blatta orientalis*	0	5%	0	0	1%	0	0	7%	9%	22%
3	*Blatta Lateralis*	10%	-*	5%	2%	-	-	-	-	-	17%
4	*Polyphaga aegyptiaca*	-	1%	-	-	-	-	-	-	7%	8%
5	*Blattella germanica*	14%	-	-	8%	-	-	-	-	-	22%
Total		27%	10%	8%	11%	3%	6%	1%	10%	24%	100%

-*not collected from indoor location

Polyphaga aegyptiaca (Egyptian Desert cockroach) that belong to the family Corydiidae (Polyphagidae) and it was least abundant of this family as compared to other recorded species with the frequency of 8%. *Polyphaga aegyptiaca* was most dominant in north zone while least recorded in west and south zones (Table 1). *Polyphaga aegyptiaca* was recorded with highest percentage (7%) in car porch while least was recorded in house floor (1%) of houses (Table 2).

Blattella germanica (German cockroaches) that belong to the family Blattellidae the most abundant of Blattellidae family with the frequency of 22%. This specie was most dominant in east zone while least recorded in west and north zones (Table 1). *Blattella germanica* was recorded with highest percentage (14%) in kitchen while least was recorded in store rooms (8%) of different house (Table 2).

Identification of family Blattidae

Periplaneta americana

Periplaneta Americana (American cockroaches) was reddish brown in color and pronotum with a yellow narrow band at lateral margin. Tegmina uniformly reddish brown in colour and large in size. Head with vertex exposed while interocular distance narrower than the width of antennal socket. Ocelli small and pronotum flattened. Femora and tibiae strongly spined while posterior metatarsus longer than the remaining joints. Sub genital plate symmetrical and divided at the posterior margin. In female sub genital plate with mesodistal portion with valves. *Periplaneta americana* is cosmopolitan specie and one of the most important the major indoor domestic cockroach pest and thrives in tropical and subtropical climates all over the world distribution (Fig. 1).

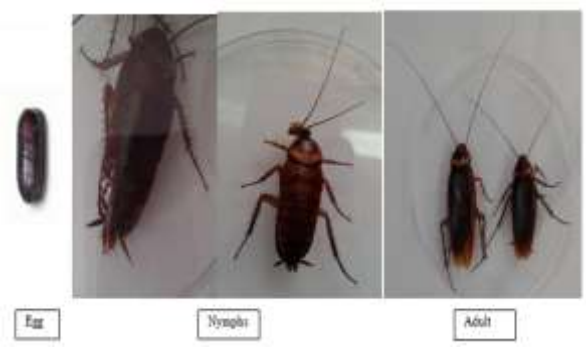

Fig. 1. Life stages of *Periplaneta americana* (Egg, nymphs and adults).

Blattaorientalis

Blatta orientalis (Oriental Cockroaches) was dark brown to black in color and has a glossy body. The male cockroaches were in smaller than female. The male looks like slender while the abdomen of female is broad. Male head with vertex exposed. Tegmina and wings reduced, which covered only about two third of abdominal terga. Sub genital plate obtusely rounded at apex. In female cockroach anteroventral margin of front femur with strongly spined and tegmina short while hind wings were absent. Sub genital plate triangular, lateral margin a little concave and It has a wider body than the male (Fig. 2)

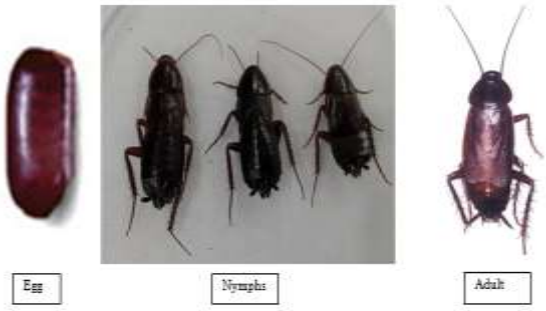

Fig. 2. Life stages of *Blatta orientalis* (Egg, nymphs and adult).

Blattalateralis

Blatta lateralis (Turkestan cockroach), was brownish orange or red, have yellowish wings that extend beyond the tip of the abdomen and have the same color markings on the margins of their body as do the females. *Blatta lateralis* was also known as the rusty red cockroach and the red runner cockroach. Males *Blatta lateralis* are larger than the females (Fig. 3).

Fig. 3. Life stages of *Blattala teralis* (Egg, nymph and adult).

Identification of family Corydiidae (Polyphagidae)

Polyphaga aegyptiaca

Polyphaga aegyptiaca specie has long, flimsy, yet textured wings. *Polyphaga aegyptiaca* was a very unusual roach specie. A male pose long and black wings.

The upper pair of wings was fixed in wavy parallel-like pattern. This was a specie of the unpopular cockroach family, but was scarcer than the other species that were commonly found inside houses (Fig. 4).

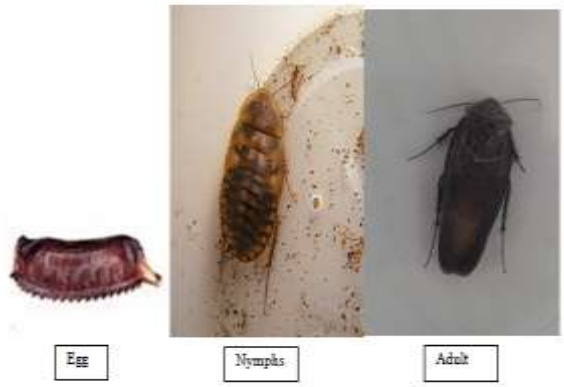

Fig. 4. Life stages of *Polyphaga aegyptiaca* (Egg, nymph and adult).

Identification of family blattellidae

Blattella germanica

Blattella germanica was small in size and head with vertex exposed. Pronotum transverse gradually rounded laterally and tegmen relatively elongated 2 to7 abdominal tergites with later caudal portion produced as lobes, 7 and 8 ter.

Supra anal plate semi circular or subtriangular, with lateral margin moderately convergent, weakly convex at the posterior region. Sub genital plate with posterior margin forming a large broad rounded lobe.

Both sexes have fully developed wings as long as the body. The female cockroach produces a small pink color ootheca. The female cockroach carrier the egg case attached with her abdomen for few hours before the egg hatch. It was a fast flying cockroach, when disturb them. The german cockroach reproduces faster than other cockroach by sexual method. The eggs case is tiny, brown and purse shaped (Fig. 5).

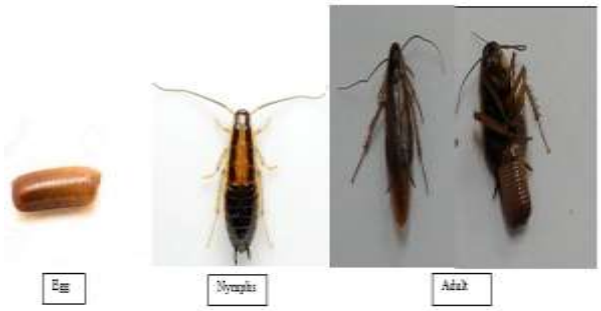

Fig. 5. Life stages of *Blattella germanica* (Egg, nymph and adult).

Discussion

The most frequent specie *Periplaneta americana* (American cockroaches) was distributed in the Balochistan Quetta. It is considered to be abundant due to favorable environmental conditions, habitat and diet. The moderate species were *Blatta orientalis* (Oriental cockroaches) and *Blattella germanica* (German cockroaches). The least abundant species was *Blatta lateralis* (Turkestan cockroaches) and *Polyphaga aegyptiaca* (Egyptian Desert cockroach).

Among all collected species with highest percentages in zone wise, east 31%, west 24%, north 23% and south 22% respectively. The collection of cockroach species percentage of indoor i.e. kitchen (27%), car porch (24%), store rooms (11%), house floor and galleries (10%), bedrooms (8%), washrooms (6%), garden (3%), while least were captured from wall cracks due to their habitat, moisture, temperature and humidity. Cockroach species has not been collected or reported recently and also many geographical regions of the country have not been studied yet, hence a systematic research is required to reveal the exact update cockroach list of the country. On the basis of morphology, Cockroaches can be easily identified and classified in different region of the world. In Pakistan there was no studies was done.

As there was no scientific work done on the cockroaches in Balochistan specifically in Quetta region, this present research was conducted to identify the local cockroach species, so as to fill partially the research gap that exists in the field of taxonomy of Blattodea.

Conclusion

Biological diversity or biodiversity refers to the variety and variability of life on earth. Balochistan is fortunately endowed with a wide range of agro-climate conditions that support the growth of an equally diverse range of plant and animals. Several species of the living organisms are disappearing and biodiversity is more threatened now than at any time in the past. It is generally believed that deforestation is the main cause behind the current crisis and along with this global climate change, shifting cultivation, soil erosion, and unchecked expansion of urban areas is the other main causes of this problem.

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