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Diversity of the Phasmids (Phasmatodea) from the Nara Desert, Sindh Pakistan

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Abstract

Nara desert can be attributed by high wind velocity, heavy shifting and rolling of sand dunes; high diurnal variation of temperature; scanty rainfall; extreme solar radiation and high rate of evapo-transpiration. Phasmids are terrestrial, nocturnal, phytophagous insects found in nearly all temperate and tropical ecosystems. Still now 3,000 species of this group has been described worldwide. Stick insects generally live in trees and bushes, but some species live entirely on grassland. The order Phasmatodea has a worldwide distribution, but most species are found in the tropics. During the present study 05 extensive trips were carried out in Nara desert in result of this survey 87 specimens of stick insect were collected and wondering only single species i-e Carausius (Dixippus) morosus which show its rare status in Pakistan. It was interesting to note that mostly the samples were captured from wheat and other wild vegetation however, its greater percentage was noticed on Acacia nilotica i-e 33.33% and least were reported from Acacia senegal i-e 11.11% female ration was high than male. Beside this, our field observation show that Carausius (Dixippus) morosus feed on fresh leaves. Beside this, it was also noted that Phasmids has strong camouflage ability to escape from predators. Further, it has close resemblance with bark, leaves and even moss or lichen.

Keywords: Phasmids, Phytophagous, Noctrounal, Camouflage, Morphological, Predators.

Introduction

Khairpur District is located in Sindh province of Pakistan. The district has an area of 15,910 km^2 and the district main city is Khairpur. District is divided into 8 Tehsil which are Nara, Faiz Ganj, Khairpur, Gambat, Thari Mirwah, Kingri, Kot Diji and Sobhodero. Among them, Tehsil Nara, is the widest and covers 73% area of the district. Nara Desert Wildlife Sanctuary having four different habitats *viz.* desert, agriculture areas, wetlands and human habitations. The Phasmatodea (also known as *Phasmida* or *Phasmatoptera*) is order of insects, whose members are known with different names in different continents, as stick insects in Europe and Australia, stick-bugs or walking sticks in the United States and Canada; or as *phasmids*, ghost insects or leaf insects (generally the family *Phylliidae)* (**Buckley and Leschen 2013**).

Phasmatodea currently includes approximately 3000 described species (**Brock *et al.*, 2016**). The phasmatodea can exhibit interesting characteristics as, firstly, most of the species among them are found to be very large in size and they resemblance to stick or leaves (**Bradler 2001).** Secondly, they all are fed on plants. Parthenogenesis can occur in a number of species and some species living in temperate zone often undergo obligatory diapauses in the egg stage during the winter to enable the organism to escape unfavorable conditions. Hence, it is not easy to find them in field because of camouflage behavior. A number of species in Phasmatids constitute the pest of agriculture, orchards, forests and fruits. They feed on a variety of plants including both Gymnosperms and Angiosperms. The rapid increase in population, phenomenal advancements in science and technology leading too much a trophogenic intervention has led to desertification becomes alarming environmental problem. Climate changes are also contributing to diversification. Considerable taxonomic work was by many authors such as **Brunner, (1907), Karny, (1923), Roberts, (1941), Hennig, (1950), Gunther, (1953), Altner *et al.*, (1978), Brock (1987), Dickens *et al.*, (1998), Danty *et al.*, (1999), Vogt *et al.*, (1999), Otte and Brock (2005), Trewick *et al.*, 2005, Buckley *et al.*, (2008, 2010),** But no work has been done from this region yet.

Methodology

Study Site

An extensive survey of the various districts of Nara desert was carried out in order to collect as many specimens of Phasmatodea as possible. The material was collected from the agricultural land, hilly, semi desert and desert areas of Nara desert. The Phasmatodea occurs in wide varieties of habitats from trees, shrubs, herbs and grasses these all habitat was inspected.

Killing and Preservation of Specimen

The collected specimen was brought into the lab by using potassium cyanide in standard entomological bottles or by chloroform after holding the specimens tightly and then positioned on the stretching board and the attention was given to the position of antenna, wings and legs through which, important taxonomic characters can be displayed. The fully dry specimens then are removed from the stretching boards and then are preserved in the insect's boxes with labels displaying the exact location, date and the name of the collector.

Identification of Samples

There were two bases made for the identification of collected specimen 1. Concealed genitalia and 2. External features. On this basis the Photographs and drawing of taxonomically important material were taken in detail and clear of the species (Carasius morosus) were prepared. The system of classification of the Phasmatodea is given by **Brunner (1907), Karny (1923), Gunther (1953)** were followed.

Statistical Analysis

Initially the data about variance was collected by different groups of researchers with time to time practical observations; here they used significant means of obtaining values. But it is another way to use (ANOVA) (SPSS 16 Software) least significant digits (LSD) for the determination.

Depository of Samples

The samples collected were deposited in the Museum of Zoology Department, EBCRL, University of Sindh, Jamshoro.

Table 1: Measurement of Different Body Parts of *Carausius morosus*

Body Parameters	Mean + S.D.	
	Male (n=10)	Female (n=10)
Length of head	5.24±0.35	6.44±0.39
Width of Head	1.20±0.18	1.82±0.29
Length of pronotum	16±0.79	23±0.79
Width of pronotum	1.21±0.17	1.70±0.30
Distance between two compound eyes	1.15±0.23	1.82±0.29
Length of femur	13.78±0.54	14.5±1.11
Width of femur	0.87±0.17	0.87±0.17
Length of tibia	14.4±0.65	15.8±1.30
Width of tibia	0.62±0.26	0.55±0.14
Length of tegmina	32±0.79	38.2±2.38
Width of tegmina	5.2±0.57	7.9±0.74
Length of wing	33.6±1.14	41.2±0.75
Width of wing	16±0.79	20±0.79
Total body length	47±1.58	57.2±2.58

Results

The material that was collected from the various localities of Nara Desert during the year 2016 to 2018 while, the number of specimen were collected 87 out of which 19 were males and 68 were females and these specimens were sorted out into single species i.e is *carausius (Dixippus) morosus* were reported by De Sinety, (1902).

Table 2: Collection of Stick Insect from Nara Desert

No. of Trips	Duration	Sampling		Total
		Male	Female	
Trip I	April to June 2017	02	15	16
Trip II	July to Sept 2017	02	10	12
Trip III	Oct to Dec 2017	01	02	03
Trip IV	January to March 2018	01	02	03
Trip V	April to June 2018	06	16	23
Trip VI	July to Sept 2018	04	16	20
Trip VII	Oct to Dec 2018	03	07	10
Total	19	68	87	

Diagnostic Features of *Carausius morosus*

Their wings are of medium size with antennae of longer length. In comparison to female the males have shorter and thinner size with brown colour. The adult females have bright red fore legs. The measured length of males is nearly 48.61mm whereas the size females are about 70.84mm. The small number of tubercles (knobs) is present on thorax. The stick insect *Carausius morosus* has a little longer body, which is a common character. The eggs laid by *Carausius morosus* are completely spherical with brown color. A layer of gill is present on fore end. Half of back is covered by brownish micropylar plate a button like yellowish capitulum. Cerci is absent at the end of the abdomen.

Table 3: Medicinal Plants and its Local Use against Different Diseases

S. #	Plants	Parts	Diseases/ Treatment
1.	*Citrullus colocynthis*	Fruits, roots and pulps	Digestive problem skin problem toothache, stomach/abdominal pain, diarrhea
2.	*Convolvulus arvensis*	Plant leaves	Problems of stomach
3.	*Euphorbia thymifolia*	Mixture of whole plant	Diarrhea, dysentery, diabetes.
4.	*Senna italic*	Mixture of plant including leaves ,roots, fruits, pulps	Old age diseases like joint pain, backache, sciatic pain.

Female Description

The female species is found in the different colors. Which starts from darkish brown up to light green. Commonly the female species was found 80mm to 100mm long. In general their front logs have reddish patches at the start area where as there was yellow patches in their mid-legs. The egg lay by female are haploid, being oval in shape and brown in color they have broad protein cover capitula at their one end. After hazing the plug of egg are opened and tiny, string in shape with dark colors young crawls out from the opening (Fig-1)

Medicinal Plants of the Nara Desert

During the survey in the different areas of Nara desert it was found some wonderful fact, related to my target, I found stick insects feeding on some plants commonly used in the field of local medicine. The local were very much aware of their medical characters. Different parts of these plants individually and their mixture are used for treatment of different human diseases (Fig-1).

Fig 1: Different View of Nara plantation from where Specimens were Collected.

Discussion & Conclusion

The work on taxonomic features of Phasmid species is done as early as **Hebard (1923, 1929 & 1933**) and **Robinson (1968a, 1968b & 1969)** studies about the protective activities of numerous Phasmids. It all makes taxonomic study very difficult so the repeated visits of localities are suggested so that species of given taxon more and more can be collected. Which are reportedly not to be present in other museums and to be diagnose the species there is insufficient number of original species are present. During visit to the hilly areas of the Nara desert during this survey the large amount of specimens were collected during the month of April to July. Field surveys were conducted during the year 2016 to 2018. The specimens were collected from the different wild vegetation and hilly areas. Most of the specimens were collected from the wheat crop.

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