CHAPTER 1

ARTHROPODS OF GIR PA: BASELINE DATA FOR VARIOUS SEASONS

INTRODUCTION

The ecological status of invertebrates in comparison to larger cats and other major mammals might be very simple. However, their role in ecological conservation and management is of high amplitude and cannot be overlooked or ignored. Invertebrates are part of nearly every food chain, either directly, as food for fishes, amphibians, reptiles, birds, mammals or indirectly as agents in the endless recycling of nutrients in soil. Food webs are often dependent on invertebrate species that perform essential services such as pollination or seed dispersal. According to biologists E. O. Wilson (1987) invertebrates are "Little Things That Runs The World", because of their number, variety and influence on larger organisms and even on entire ecosystems. Without invertebrates ecosystem would collapse.

The animal kingdom has just over a million scientifically described species categorized into thirty-two phyla. Out of these, phylum arthropoda has an estimated 1,085,000 identified species, or 82% of total identified species (Wilson, 1987). This means, by any measures, the most successful animals on the planet are the arthropods. Due to their varied body forms and ability to adapt to any type of habitat they have conquered land, sea and air and comprise over three fourth of all currently known living and fossil organisms, or over one million species in all. Since many arthropod species remain undocumented or undiscovered, especially in tropical rain forests, the true number of living arthropod species may run into probably in the tens of millions. One recent conservative estimate puts the number of arthropod species in tropical forests at 6 to 9 million species (Thomas, 1990).

Arthropods represent a fundamental component of the ecosystems, comprising the majority of biological diversity and essential to processes of nutrient cycling, decomposition, predation, herbivory, parasitism, and pollination. The functions of arthropods are complex and important because they interact with other organisms in three general ways, as providers, eliminators, and facilitators (Miller, 1993).

Arthropods provide byproducts, such as honeydew and cadavers that sustain other organisms. As eliminators, arthropods remove waste products and dead organisms from ecosystems. In this capacity, arthropods help in recycling plant and animal material and the nutrients they contain, and facilitate tree and plant growth (Setälä and Huhta, 1991). Food items passing through herbivorous arthropods form aggregates that increase soil nutrient and water storage capacity and reduce erosibility of soil (Hendrix *et al.,* 1990, Eldridge 1994, Schowalter 2000). Arthropods act as facilitators when they carry or vector other predaceous or decomposer organisms through forests. Arthropods are a good example of proliferation of animal forms. They have produced species numerically almost with out an end, for almost every kind of habitat and diet, to almost every kind of parasitism and symbiosis. Through the process of natural selection, many arthropods have developed remarkable abilities to distinguish themselves, either by blending in with their surrounding or by imitating another species (Blest, 1963, Eiser *et al.,* 1978, Green *et al*; 1987, Körner, 1982; Mather and Roitber, 1987, Green, 1989; Brakefield *et al.*, 1996,). Arthropods also help the system by serving as check on each other's populations through predation (Lattin, 1993).

Phylum arthropoda contains a wide array of animals from spiders to prawns to every other bug, mite, or tick on the planet. Arthropods have specialized to fill almost every possible niche and are found in such a huge number that they are literally the glue that holds together most habitats (Docent Bulletin, 2003). Moreover, they play a primary role in the function of natural ecosystems and are now frequently mentioned as important components of diversity that need to be identified and conserved (Ehlrich and Mooney,1983; May,1986; Wilson,1988;Lattin and Moldenke,1990; Lerdau,1997). Arthropods make them ideal study organisms because of their short generation time and rapid population growth. These characteristics make them ideal as early warning indicators of environmental change and for monitoring recovery at disturbed sites. Due to importance of these organisms in ecosystem processes, monitoring their diversity provide important insight into effects of forest conservation techniques. Knowledge of arthropod diversity, abundance and distribution can further provide extremely useful information in evaluation of environmental perturbation and biological integrity. The vast diversity of species offers the opportunity to integrate a number of sensitive indicator species into environmental assessments. Terrestrial arthropods have been suggested as an effective umbrella group and are good

indicators for monitoring any terrestrial ecosystem (Kremen *et al.*, 1993). Arthropod fauna of forest floor can be highly diverse (Andre *et al.*, 1994) and their diversity enhances system complexity, which in turn influence ecosystem stability.

Arthropod, the largest phylum is represented by more than 50,000 species in India (Z.S.I, 1991). Unfortunately, only 743 species are reported from Gujarat (Z.S.I 2000). Some isolated studies on scorpions (Sabnis and Amin, 1992), pseudoscorpions (Patel and Kareemullah, 1989) and mites (Sabnis and Amin, 1992) and role of spiders in agroecosystem (Siliwal, 2000) have been carried out in Gujarat. However, arthropods on the whole have not been studied in detail in Gujarat. The present study area with heterogeneous habitat and diverse vertebrates including the majestic Asiatic lion is poorly studied for its arthropod diversity. Thus, Arthropods were chosen as target group to establish the extent to which an invertebrate assemblage matches the huge number of plants and animals surrounding it.

Arthropod phylum is been variously classified by diverse workers however, in the present work one followed the classification as adopted by Hickman (1998). The Arthropod fauna recorded during the current study comprises of five classes viz. Crustacea, Diplopoda, Chilopoda, Arachnida and Insecta. The most numerous amongst all the classes-the insecta (Figure 1.1) is been treated separately elsewhere (Chapter 2).

Crustaceans are primarily marine forms, but many are found inhabiting in freshwater and in terrestrial habitat. They are good indicators of stressed polluted condition, and thus play an important role in ecosystem. They are important as food and in turn are valuable for other animals. There are currently more than 800 crustaceans known world over (Martin and Heyning, 1999).

Chilopods are predatory and feed on soil invertebrates. They have been found feeding on millipedes, grubs of beetles, larvae of butterflies and moths, termites, etc. (Khanna, 1977a). By such feeding habit they keep check on population of harmful pests of agriculture as well as forests. Whereas, Diplopods are primarily herbivorous feeding mostly on decaying plant tissue, which includes leaf litter, fungi, fruiting bodies and excrement of herbivorous mammals. Ecologically millipedes (diplopod) are important as they play major role in soil aeration as well as humification of the soil, they are called " Macro degrader" and are useful as soil indicators for some of the forestlands (Ghilarov, 1965).

Arachnida includes Spiders, scorpions, ticks, mites etc. Scorpions are nocturnal in habit and live in burrows, cracks of stones, leaf litter, barks etc. They are abundant in tropical and sub tropical zones. Solpugids "false spiders" or "wind scorpion" are nocturnal, exclusively predatory and carnivorous. Though they principally are desert forms but they are found living in forest in India. They feed upon insects, spiders, scorpions and small lizards (Tikader, 1987a). Pseudoscorpions or "False scorpions", they are found in dark places, between the leaves, under bark, in soil, bird's nests. They are exclusively carnivorous and feed on living or recently killed prey. Their chief food source is collembolans, thysanurans and other small insects. Cannibalism has been observed in some Indian species (Murthy and Ananthakrishnan, 1977). Mites and ticks are major constitute of soil fauna. Spiders, which are the dominant ground dwelling non-vertebrate predators in many ecosystems, play a substantial role as biological regulators. They are distributed worldwide. Spiders represent a diverse and functionally important group of Arthropods. The assessment of their status can provide much useful information in monitoring the integrity of biotic communities (Glesne, 1998).

OBSERVATIONS

In the present study on Arthropods other than insects, a total of 81 species were observed representing 14 orders and 43 families of class Crustacea (21%), Chilopoda (21%), Diplopoda (14%) and Arachnida (43%) and are enlisted as follows:

PHYLUM: ARTHROPODA

1. **Class:** Crustacea
   - **Order:** Decapoda
     - **Family:** Potamanidae
       1. *Paratelphus* (*Brytaelphus*) *jaquemonti* (*Rathbun*)
     - **Family:** Atyidae
       2. Macrobrachium rosenbergii
   - **Order:** Cladocera
     - **Family:** Daphniidae
       3. *Daphnia spp.*
   - **Order:** Isopoda
     4. *Oniscus* spp.
2. **Class:** Diplopoda
   - **Order:** Polydesmida
     - **Family:** Polydesmidae
       5. *Polydesmus spp.*
       6. *Spirostreptus spp.*

Order: Spirobolida

7.Unidentified spp.

3. Class: Chilopoda

Order: Scutigeomorpha

8.Unidentified spp.

Order: Lithobiomorpha

9. Unidentified spp.

Order: Scolopendromorpha

Family: scolopendreadae

10.*Scolopendra* spp.

4.Class: Arachnida

Order: Acarina

Family: Ixodidae

11.*Amlelyomma spp.*

12.*Haemaphysalis spp.*

13.*Rhipicephalus spp.*

14. *Nosomma monstrosum*

15. *Boothilus micreplus*

Family: Thrombididae

16. *Thrombidium gigas*

Order: Scorpionida

Family: Scorpionidae

17.*Heterametrus* swarmmerdami (Simon)

18.*Heterametrus phipsoni* (Pocock)

Family: Buthidae

19.*Mesobuthus* (Vachon) *talmulus talmulus* (Fabr.)

Order: Pseudoscorpionida

Family: Peudoscorpionidae

20 Unidentified spp.

Order: Solpugida

Family: Solpugidae

21. Unidentified spp.

Order: Phalangida

Family: Phalangidae

22. Unidentified spp.

Order: Aranea

Family: Atypidae

23.*Atypus southerlandi* (Gravele)

Family: Amaurobiidae

24. *Amaurobius spp.*

Family: Dictynidae

25. *Dictyna spp.*

26. *Dictyna putus* (Cambridge)

Family: Oecobiidae

27. *Oecobius spp.*

Family: Filisatidae

28.*Filistata spp.*

Family: Dinopidae

29.*Dinipis goalparaensis* (Tikader & Malhotra)

Family: Scytodidae

30. *Scytodes thoracica*

Family: Loxoscelidae

31.*Loxoscelis indrabeles* (Tikader)

Family: Ctenidae

32.*Ctenus spp.*

Family: Thomisidae

33.*Xysticus spp.*

34.*Thomisus spp.*

35. *Tibellus spp.*

Family: Salticidae

36.*Salticus spp.*

37.*Plexippus paykullii* (Acdonin & savigny)

38.*Phidippus spp.*

39.*Myrmerachne spp.*

Family: Hahniidae

40. *Hahnia spp.*

Family: Lycosidae

41.*Hippasa spp.*

42.*Hippasa madhuae*

43.*Hippasa lycosina*

44.*Evippa spp.*

45.*Lycosa spp.*

Family: Oxyopidae

46.*Peucetia spp.*

47.*Oxyyopes wroughtonia* (Pocock)

48.*Oxyopes spp.*

Family: Tetrablemmidae

49.*Tetrablemma deccanesis* (Tikader)

Family: Selenopidae

50.*Selenops spp.*

Family: Urocteidae

51.*Uroctea indica* (Pocock)

Family: Eresidae

52.*Stegodephus spp.*

Family: Stenochilidae

53.*Stenochilus spp.*

Family: Homalonychidae

54.*Homalonychus joyaus* (Tikader)

Family: Platoridae

55.*Plator spp.*

Family: Tetragnathidae
56.*Tetragnatha spp.*
57.*Eucta spp.*
58. *Tylorida spp.*
Family: Pisauridae
59. *Pisaura spp.*
Family: Araneidae
60. *Cyclosa spp.*
61.*Cyclosa moonduensis* (Tikader)
62.*Argiope pulchella*
63. *Argiope aemula*
64.*Larinia chloris*
65.*Cytophera cicatrosa*
Family: Theridiidae
66.*Thridion tikaderi* (Patel)
67.*Thridion spp.*
68.*yllognatha surajbae* (Patel)
69. *Argurodes spp.*
Family: Clubionidae
70.*Clubiona pashabhaii* (Patel & Patel)
71.*Casianeira tinae* (Patel & Patel)
Family: Pholcidae
72. *Crossopriza lyoni* (Blackwell)
Family: Zodaridae
73. *Storena spp.*
Family: Ulorobidae
74.*Uloborus krishnae* (Tikader)
75.*Uloborus khasiensis* (Tikader)
76.*Uloborus danolius*
77.*Uloborus spp.*
Family: Gnaphosidae
78.*Megamyrmecoion spp.*
79. *Drassodes spp.*
80. *Scotophaeus spp.*
Family: Hersillidae
81.*Hersila savignyi* (Lucas)

An analyses of species richness has shown that the most dominant amongst the four classes is Arachnida (Figure 1.1)

Occurrence of Arthropods during the entire span of the study period was noted down in Gir PA having three different study sites (Study Area and Methodology). Based on the number of times they were encountered they were given abundance rating.

Those animals, which were sighted more than 32 of the visits were rated COMMON, less than 15 of the visits were UNCOMMON and less than 5 of the visits were rated as RARE (Table 1.1).

Crustaceans were represented by 4 species belonging to 3 orders *viz.* Isopoda, Decapoda and Cladocera. They being aquatic crustaceans were recorded from major water reservoirs of the study area. Isopods and cladocerans were commonly found whereas Decapodans were uncommon. Diplopoda and Chilopoda (Figure 1.2) in general showed their occurrence during monsoon season. Diplopods were always observed in good numbers, more than 50 at a single sight. This class was represented by three species belonging to two orders, Polydesmida and Spirobolida. Animal of these two orders were sited only during monsoon.Three orders *viz.*, Scutigeomorpha, Lithobiomorpha and Scolopendromorpha and one species from each of these orders are recorded from the study area. Members of this class were always encountered singly.

Arachnids (figure 1.3 – 1.6) formed the dominant component of Arthropod with diversity next only to Insecta. A total of seventy one species belonging to six orders were observed in the current study. However, compared to other classes of arthropods, arachnids showed minimal temporal variations round the year (Figure 1.7 - 1.12). Scorpions showed their occurrence more dominantly in the thorny scrub area under bark, stones and leaf litter. Three species of scorpions were collected from the study area and they were commonly sighted from thorny scrub patch of all the three study sites. One of the striking observations was the presence of Solpugida, which is a characteristic representative of desert habitat. It was represented by a single species and was rarely sighted. Order phalangida and order peudoscorpionida are also reported by single species. Of which, phalangida was common at site-II (Gir N.P) than at the other two sites and peudoscorpionida was common at all sites.

Amongst the arachnids the spiders were the most dominant species observed during the total span of the study. In all fiftynine species of spiders were identified. This order (araneae) of class arachnida was prevalent throughout the study area.

However, it was also observed that Arthropods are maximally represented during monsoon, moderately during winter and least during summer.

CONCLUSIONS:

Sporadic account of Arthropod diversity of some Indian National Parks and Sanctuaries is available (Patel and Kareemullah, 1989; Sabnis and Amin, 1992; Alfred and Chandran, 2000). However, a comprehensive and systematic study on Arthropod diversity is completely lacking. The preliminary studies on invertebrates in the study area by Parikh (2001) have shown that Arthropods were the most dominating group amongst the Invertebrates.

Arthropods of Gir PA are evenly distributed forming an integral part of the forest ecosystem (Table 1.1). Arthropods comprise of 80 – 90% of the total species of most of the forest ecosystems (Asquith *et al.*, 1990). Arthropods in general are basic consumers in the forest (Schowalter, 1989, 1995) and play a major role in natural ecosystems (Schultz and Mooney, 1993; Lerdau, 1997).

Arthropod fauna was represented by comparatively sparse number of representatives of Crustacea, Chilopoda, and Diplopoda. This could be because these groups were not intensively studied. However, Chilopoda and Diplopoda were sighted more during monsoon season, which suggests that increased humidity and more detritus condition facilitated their occurrence. Similar observations were also made by other workers (Rathinasabapathy and Yadav, 1999; Finnamore, 1992). It was observed that millipedes were feeding on leaves that were not broken down by other organisms, but preferred weathered leaves. These organisms also eat decaying wood, though they may be digested with the help of microbial flora in their gut. It appears that the actions of millipedes serve in the chemical breakdown and humification of litter, but their most important role in decomposition and nutrient cycling is the fragmentation of vast amounts of litter. Similar opinion made by, Finnamore, (1992) further augments the present notion.

It was observed during the current study that the Arachnids were the most paramount group of Arthropods. However spiders, with fifty-five representative species, formed the dominant group of organisms amongst arachnids. Studies carried out by Sabnis and Amin (1992), Patel and Vyas (2001), Patel (2003) have recorded rich spider diversity in the National Parks and sanctuaries of Gujarat. Number of spiders was more during monsoon season than in winter and summer. Their dominance during monsoon at the study area can be attributed to more

humidity and density of vegetation. Similar observations were also been made by De Bakker and coworkers (2000).

The richness of spiders in the forest ecosystem suggests their tight coupling with a large number of ecological processes. Spiders are among the dominant invertebrate predators of the terrestrial ecosystem (Turnbull, 1973; Wise, 1993; Patric *et al.*, 1999) and play a major role in invertebrate community dynamics (Moulder and Reichle 1972; Riechert, 1974; Wise, 1993). Most of the spiders are generalist predators (Nyffeler, 1999), feeding primarily on insects and secondarily on other spiders but have strict habitat requirements (Gertsch, 1979). Because of their high abundance and predominantly insectivorous feeding habit, spiders play an important role in controlling insect pest (Mason *et al.*, 1997). There are also evidences that the density behavior and population dynamics of spiders act to stabilize terrestrial arthropod population (Breymer, 1966; Turnbull, 1973, Riechert, 1974; Enders, 1975).

The data collected thus form baseline information to understand the temporal changes in the study area. However, it is necessary to acquire more information on community structure, abundance and distribution to determine appropriate levels of protection for ecosystem processes and functions.

TABLE 1.1 Abundance Grading of Classes of Arthropoda at Study Area

CLASS	ORDER	STUDY SITES		
		Site-I	Site-II	Site-III
Crusacea	Isopoda	C	C	C
	Decapoda	UC	UC	UC
	Cladocera	C	C	C
Chilopoda	Scutigeomorpha	UC	UC	UC
	Lithobiomorpha	UC	UC	UC
	Scolopendramorpha	C	C	C
Diplopoda	Polydesmida	C	C	C
	Spirobolida	C	C	C
Arachnida	Acarina	C	C	C
	Scorpionida	C	C	C
	Pseudoscorpionida	C	C	C
	Solpugida	R	R	R
	Phalangida	UC	C	UC
	Araneida	C	C	C

C=COMMON, UC=UNCOMMON, R=RARE

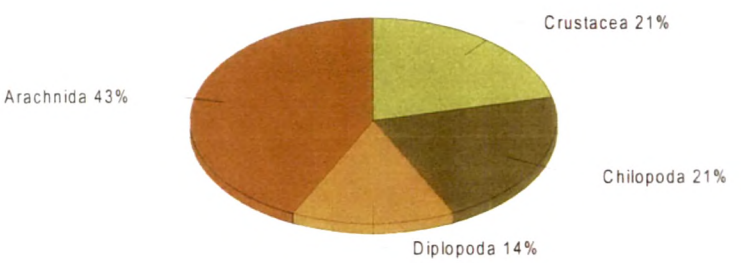

FIGURE 1.1 Composition of arthropods other than insects recorded from study area

FIGURE1.2 Chilopods of study area

FIGURE 1.3 Crab from Gir P A

FIGURE 1.4 "Desert Scorpion" Solpugidae

FIGURE 1.5 scorpion

FIGURE 1.6 Hersillidae Spider

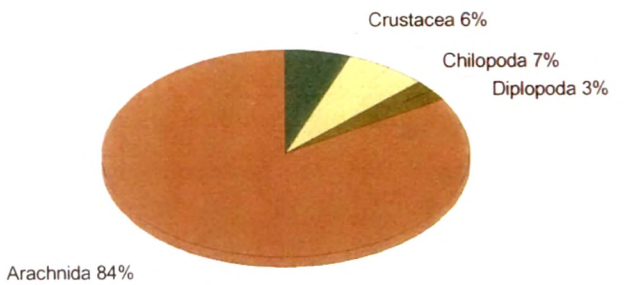

FIGURE 1.7 Distribution of arthropods other than insects during monsoon 2000

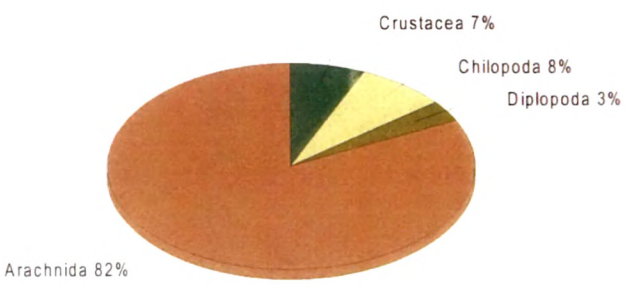

FIGURE 1.8 Distribution of arthropods other than insects during monsoon 2001

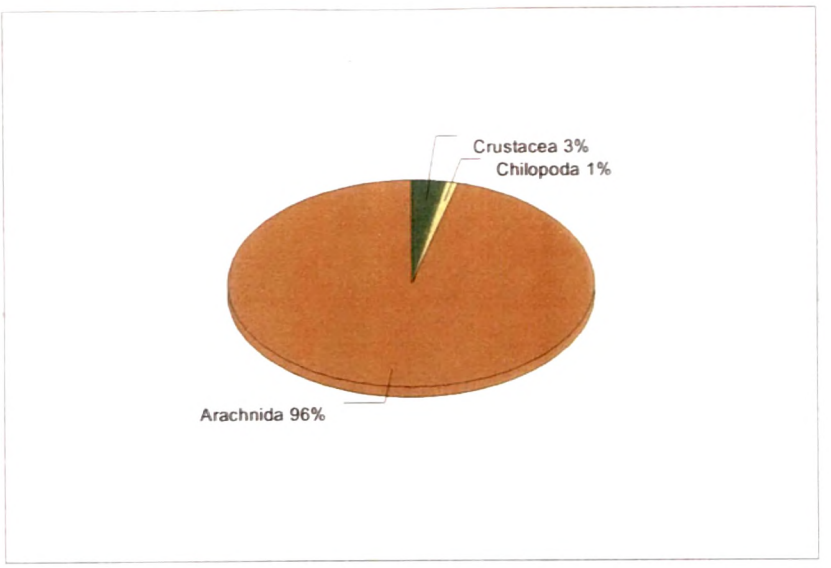

FIGURE 1.9 Distribution of arthropods other than insects during winter 2000

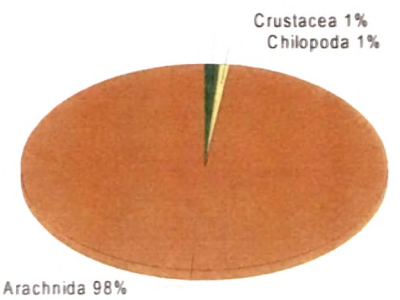

FIGURE 1.10 Distribution of arthropods other than insects during winter 2001

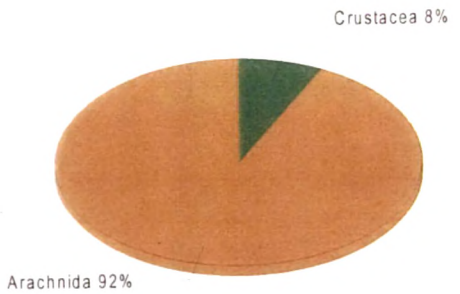

FIGURE 1.11 Distribution of arthropods other than insects during summer 2000

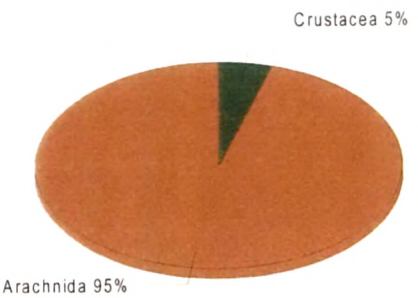

FIGURE 1.12 Distribution of arthropods other than insects during summer 2001