International Journal of Fauna and Biological Studies
Available online at www.faunajournal.com

IJFBS International Journal of Fauna And Biological Studies

ISSN 2347-2677
IJFBS 2016; 3(5): 120-123
Received: 20-07-2016
Accepted: 21-08-2016

US Deshmukh
Department of Zoology
Government Vidarbha Institute of Science and Humanities, Amravati, Maharashtra, India

PW Chaudhari
Department of Zoology
Government Vidarbha Institute of Science and Humanities, Amravati, Maharashtra, India

Correspondence
US Deshmukh
Department of Zoology
Government Vidarbha Institute of Science and Humanities, Amravati, Maharashtra, India

Study of spider fauna from orange agro ecosystem in the catchment area of upper Wardha dam, Amravati, Maharashtra, India

US Deshmukh and PW Chaudhari

Abstract
Spiders are important predators in terrestrial ecosystem and biological control agent against pest in agro ecosystems. The present study was conducted to survey the spiders diversity in ten different Orange farms from the catchment area of Upper Wardha dam, Amravati, Maharashtra, India. Survey was done from June- 2011 to May-2012 during day time from 8 A.M. to 6 P.M. every weekend. Total 219 individuals were collected during the survey including 49 species from 22 genus and 9 families from Orange farms.

Keywords: Agro ecosystems. Orange, Spider diversity, Upper Wardha Dam

Introduction
India ranks sixth in the production of citrus fruit in the world and citrus fruits rank third in area and production after banana and mango in India. Oranges are the second largest citrus fruits cultivated in the country. Andhra Pradesh, Maharashtra, Karnataka, Punjab, Haryana and Rajasthan are main orange growing states. Maximum area under oranges is in Andhra Pradesh, followed by Maharashtra and Karnataka. The well marked belts of citrus cultivation in the Vidarbha region include Morshi, Warud, Chandur Bazar and Nagpur.

In agro ecosystem role of spiders is very important because they limit the growth of insect pests. (Snyder and Wise, 1999; Nyffeler, 2000; Sigsgaard, 2000; Maloney *et al*, 2003; Venturino *et al*., 2008; Chatterjee *et al*., 2009) [16, 10, 15, 8, 19, 3].

Insect pests such as *Papilio demoleus* (citrus caterpillar), *Dacus dorsalis* (oriental fruit fly) and *Indarbela tetraonis* (Bark eating caterpillar) are the major pests of orange crop and bark which highly damage the stem, root, bark and fruits of orange plant in different seasons of a year. To prevent from such pests pesticides are of tenly used to optimize pests management in orange crops but along with these pests some important arthropod fauna also gets destroyed.

Spiders are common in agro ecosystems making up to 20-80% of predatory fauna (Legotay, 1980; Zhang, 1992) [7, 22]. In orange agro ecosystem spiders are most abundant predators of insects and pests. Large number of spider are often present on citrus trees as reported in other countries (Shulow 1938; Carroll,1980; Mansour *et al*., 1982; Mansour & Whitecomb,1986) [14, 2, 9].

The current world list of spiders includes 45,776 species under 3974 genera distributed over 114 families (WSC, 2016). In India they are represented by 1686 species belonging to 438 genera of 61 families (WSC, 2015) [21]. There still exist major gap in our knowledge about diversity of spiders in many areas of within wide-ranging ecosystems of India.

Spiders are potential biological agents in agro ecosystems (Riechert and Bishop, 1990) [12]. Many researchers have provided description of spiders species abundance or composition in a variety of agro ecosystem (Wisniewska and prokopy, 1997) [20].

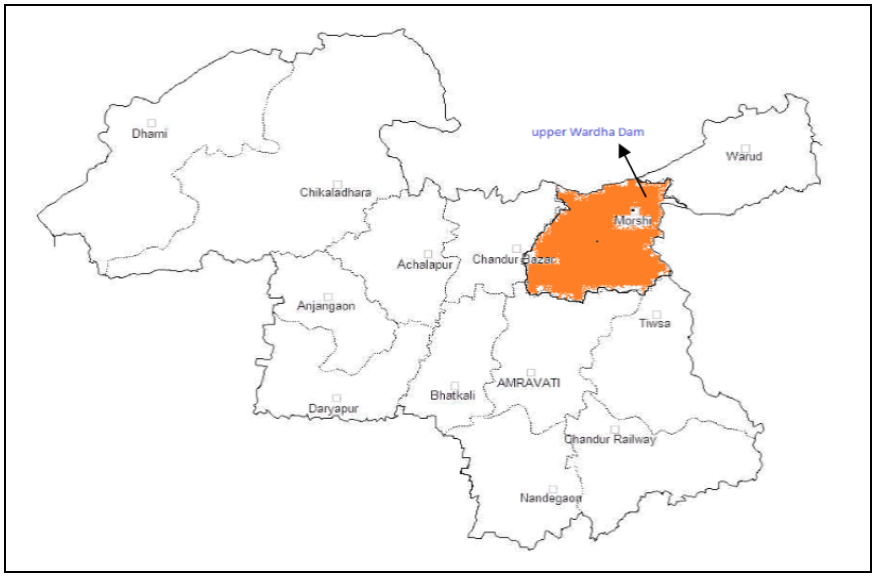
Much field evaluation conducted over several years and demonstrated that spiders can reduce insect population and crop damage they cause. The knowledge on diversity and distribution of spiders in India is rare as compared to the other regions of the world. The broad descriptions on Indian spiders are given by Tikader (1987) [18]; Sebastian and Peter (2009) [13].

In India, studies about the population and abundance of the spider assemblage in agricultural crops are very rare, but some studies were carried out by Pathak and Saha (1999) [11] and Bhattacharya in (2000) [1]. But these studies were not yet identified all the fauna of spiders hence this survey is an attempt to study the fauna associated with Orange crop, conducted

during June- 2011 to May-2012 and the efforts were made to study diversity and richness of spiders among Orange fields around the area of Upper Wardha Dam.

Materials and Methods

A) Study Area



Map showing catchment areas under Upper Wardha Dam.

The area selected for collection of spiders is the Orange agro ecosystem near catchment area of Upper Wardha dam; it is an earth fill dam across the Wardha River, a tributary of the Godavari River, near Simbhora village in Morshi taluka, Amravati district (Maharashtra state). The dam provides multipurpose benefits for irrigation, drinking water supply, flood control and hydropower generation. (Data base on Godavari Basin, Wardha 2011).

B) Methods

The spiders were collected and preserved according to Tikader (1963) [17]. Immature spiders were left to its habitat; repetition of collection was avoided. Spiders were collected in the dry containers, photographed and then preserve in 70% alcohol.

1) **Sweep netting:** Spiders from herbs, shrubs and small tree vegetation were collected using standardized insect-collecting net. 15-20 sweeps were employed in selected area.
2) **Beating sheets:** Spiders from trees and woody shrubs were dislodged and collected on a sheet by beating trees and shrubs with a stick. Few beats per tree or shrubs were employed in selected area.
3) **Active Searching and Hand Picking:** Spiders from all three layers were collected. In these method spiders specimens were actively searched under rocks, wood, grounds debris, and loose dead barks of trees on the ground surface.

C) Statistical analysis

Shannon Wiener Diversity Index

$H = - SUM [(Pi)^{*} In (pi)]$ E = H/H max

Where,

SUM = Summation Pi = number of individuals of species I/ Total number of species

S = Number of species or species richness

H max = Maximum diversity possible

E = Evenness = H/H max

Results & Discussion

Present study was carried out during June 2011 to May 2012 to investigate the spider fauna in Orange fields in the catchment area of Upper Wardha Dam, Dist. Amravati Maharashtra. Total 49 numbers of spider species were recorded belonging to 22 genera under 9 families. The collected species included 31 females and 18 males.

Distribution of families

Spiders from family Salticidae were observed throughout the survey area as well as throughout the year, representing highest no. of species (12), which were followed by Araneidae (11), Lycosidae (6), Oxyopidae (4), Tetragnathidae (5), Thomosidae (4), Erasidae (3), Pholcidae (2), Theridiidae (2), Table no. 1. Thus family Salticidae is the most dominant family exploring 25% of species second leading family is Araneidae with 22% of species, the third most diverse family is Lycosidae with 13% of species, family Tetragnatidae represents 10% of species, families Oxyopedae and Thomicidae exhibit 8% of species, family Erasidae with 6% of species, Family Pholcidae and family Theridiidae display 4% each of the total species diversity. And the samples of 9 families with 49 species are 11,3,6,4,2,12,5,2,4 the Shannon Wiener diversity index and Evenness for these sample values are, Shannon diversity index (H) = **1.98** Evenness = 0.9

During survey it was observed that spiders belonging to family Araneidae, Oxyopidae and Eresidae were mainly found on vegetation. The Tetragnathidae were found on reeds near moist areas in the orange fields, while the Thomisides and Philodromids were mainly collected from flowering plants, Miturgidae were founds on the leaves of plants; Theredиids and Thomisidae were located on barks of the tree. Hippasa were observed in funnel webs, a tunnel of silk made on the ground over grass. On other hands most spiders from different families living on ground or on vegetation exhibited some kind of protective coloration for camouflage, good

examples of mimics among these species a juvenile ant-like jumping spiders from Saltisidae (Genus- *Myrmarachne*) and Lycosidae (Genus-*Hippasa*).

Due to carnivorous and cannibalistic nature sociality among spiders were very rare, however a social species, *Stegodyphus sarasinorum* (Family: Erasidae) was also represented during survey in catchment area of Upper Wardha Dam.

Spiders of family Saltisidae mostly feeds on small insects, Thomisids feed on flower insects, *Araneus mitificus* mostly feeds on red mites and bugs which protects bark of the tree from damage hence spiders are useful to plants in all aspects but yet spiders have not received serious attentions. And in agro ecosystems pesticides may dramatically influence their diversity. It would be worthwhile designing insecticides in such a way that they are less toxic to spiders.

Table. Number of genera and species of spiders families from Orange agro ecosystem in the catchment area of Upper Wardha Dam, Amravati

Sr. No	Families	No. of Genus	No. of Species
1	Araneidae	05	11
2	Erasidae	01	03
3	Lycosidae	02	06
4	Oxyopidae	01	04
5	Pholcidae	01	02
6	Salticidae	07	12
7	Tetragnathedae	02	05
8	Theridiidae	01	02
9	Thomisidae	02	04

Shannon Wiener Diversity Index

H = - SUM [(Pi)* In (pi)] E = H/H max

Where,

SUM = Summation Pi = number of individuals of species I/ Total number of species

S = Number of species or species richness

H max = Maximum diversity possible

E = Evenness = H/H max

The samples of 9 families with 49 species are 11,3,6,4,2,12,5,2,4 the Shannon Wiener diversity index and Evenness for these sample values are,

Shannon Wiener diversity index and Evenness i

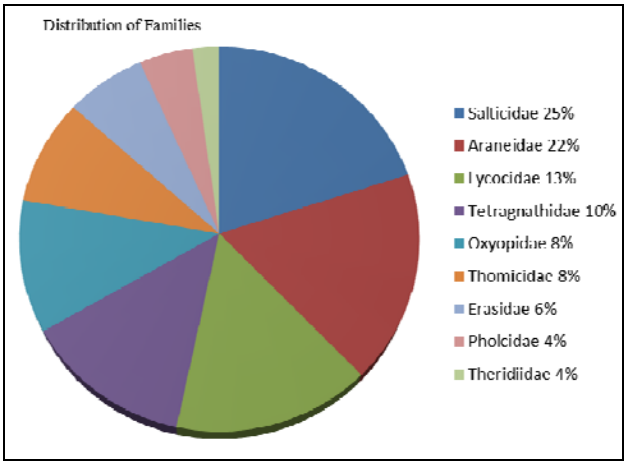
Sum =	11,3,6,4,2,12,5,2,4
	= 49

Sample Values (S) = 49 number of species (N) = 9

Sr. No	No. of Sample	Pi= Sample / Sum	In(pi)	Pi*In(pi)
1	11	0.22	-1.51	-0.3322
2	3	0.06	-2.81	-0.1686
3	6	0.12	-2.12	-0.2544
4	4	0.08	-2.52	-0.2016
5	2	0.04	-3.21	-0.1284
6	12	0.24	-1.42	-0.3408
7	5	0.10	-2.30	-0.2300
8	2	0.04	-3.21	-0.1284
9	4	0.08	-2.52	-0.2016
	Sum= 49			H= -1.98

H max = ln(N) = ln(9) = 2.19 Evenness = H/Hmax = 1.98/2.19 = 0.90

Shannon diversity index (H) = 1.98, Evenness = 0.9



Shannon - Wiener diversity index (H) is 1.98 and evenness of species is found to be 0.9.

List of spider species recorded during the study

Family- Araneidae

- *Argiope* species (Female)
- *Araneus mitificus* (Female)
- *Araneus* species (Male)
- *Araneus* species (Female)
- *Cyclosa hexatuberculata* (Female)
- *Cyclosa simony* (Female)
- *Cyclosa moondensis* (Female)
- *Gasteracantha* species (Female)
- *Neoscona* species (Female)
- *Neoscona theis* (Male)
- *Neoscona* species (Female)

Family- Erasidae

- *Stegodyphus* species (Female)
- *Stegodypus sarasinorum* (Male & Female)

Family- Lycosidae

- *Hippasa holmerage* (Female)
- *Hippasa pisuarina* (Female)
- *Hippasa* species (Male)
- *Hippasa* species (Male)
- *Hippasa* species (Female)
- *Lycosa* species (Female)

Family- Oxyopidae

- *Oxyopes pankaji* (Male)
- *Oxyopes pawani* (Female)
- *Oxyopes* species (Male)
- *Oxyopes* species (Female)

Family- Pholcidae

- *Pholcus* species (Male)
- *Pholcus* species (Female)

Family- Salticidae

- *Euophrys* species (Female)
- *Mirmanchneae* species (Male)
- *Mirmanchneae* species (Female)
- *Phidippus* species (Male)
- *Phidippus* species (Female)

- *Plexippus* species (Male)
- *Plexippus* species (Female)
- *Telamonia diamidiata* (Female)
- *Telamonia elegans* (Male)
- *Telamonia elegans* (Female)
- *Marpissa* species (Female)
- *Phintella vittata* (Female)

Family- Tetragnathedae

- *Leucauge decorata* (Female)
- *Lecauge decorata* (Male)
- *Tetragnatha mandibulata* (Male)
- *Tetragnatha mandibulata* (Female)
- *Tetragnatha* species (Male)

Family- Theridiidae

- *Theridion* species (Male)
- *Theridion* species (Female)

Femaly- Thomosidae

- *Thomisus* species (Male)
- *Thomisus* species (Female)
- *Xysticus* species (Male)
- *Xysticus* species (Female)

Conclusion

Spiders from family Araneidae, salticidae and Lycosidae are dominantly observed as compared to other in the orange fields. All the spiders as they predate insects/pests they help to keep insect population under control, therefore farmers should aware about the use of spiders in agroecosystems.

References

1. Bhattacharya S. Biodiversity of spiders in the rice fields of Kalyani, West Bengal, India. Research Journal of Chemistry and Environment. 2000; 4(2):75.
2. Carroll DP. Bioogical notes on the spider of some citrus growes in central and Southern California. Entmol. News, 1980; 91:147-154.
3. Chatterjee S, Isaia, Venturino E. Spiders as biological controller in agro ecosystems. J Theoretical boil. 2009; 258:352-362.
4. Data Base On Godavari Basin, Wardha. Wardha. Sakti, Voluntary Organization. 2011. http://www.Sakti.in/godavaribasin/tributaries.hmt. Retrieved 21 March 2011.
5. Fadel Mansour, Whitecomb W H. The spiders of a citrus grove in Israel and their role as biocontrol agents of *Ceroplastes floridensis* [*Homoptera: Coccidae*], Phytoparasitica, 1988; 16(4):317-325.
6. Gajabe PU. Spiders of Jabalpur Madhya Pradesh (Arachnida-Aranae), Rec. Zool. Surv. India, 2004; 227:1-154.
7. Legotay MV. [Spiders of Wheat crops of transcar-pathia]//Entomophagi verditeley rasteniy [Entomophagous predators of pest] Kishine V.S. 1980, 28-33 [in Russian].
8. Maloney D, Drummond FA, Alford R. Spider predation in Agroecosystem; Can spiders effectively control pest population? Maine agric. For. Exp. Station Tech. Bull. 2003, 190:32.
9. Mansour, Fadel, Ross JW, Edward GB, Whitcomb WH, Richman DB. Spiders of Florida citrus groves. Fla Entomol, 1982; 65:514-522.
10. Nyffeler M. Ecological impact of spiders predation; A critical assessment of Bristowe's and Turnbull's estimates. British Arachnological Soc., 2000; 11(9):367-373.
11. Pathak S, Saha NN. Spider fauna of rice ecosystem in Barak Valley Zone of Assam, India. Indian journal of Entomology. 1999; 2:211-212.
12. Riechert SE, Bishop L. Prey control by an assemblage of genera list predators: spiders in garden test system. Ecology, 1990; 71(4):95-119.
13. Sebastian PA, Peter KV. Spiders of India, First edition, University Press Hyderabad, 2009.
14. Shulow A. Observation on citrus spiders. Harder, 1938; 11:206-208.
15. Sigsgaard L. Early season natural biological control of insects pests in rice by spiders-and some factors in the management of the cropping system that may affect this control. European Arachnol. 2000, 57-64
16. Snyder WE, Wise DH. Predator interference and the Establishment of genera list Predators population for biocontrol. Biological control, 1999; 15:283-292.
17. Tikader BK. Studied spider fauna of Maharashtra and Mysore State Part. I. J. Univ. Poona, Sci. And Tech. 1963; 24:29-54.
18. Tikader BK. Handbook of Indian Spiders. Zoological survey of India, Calcutta, India, 1987, 251.
19. Venturino E, Isaia, Bona F, Chatterjee S, Badino G. Biological control of intensive agro ecosystems: Wanderer spiders in the Langa Astigiana. Ecological complexity, 2008; 5:157-164.
20. Wisniewska J, Prokopy RJ. Pesticide effects on faunal composition, abundance, and body length of spiders (araneae) in apple orchards. Environmental Entomology, 1997; 26:763-776.
21. World Spider Catalog. World spider catlog, Natural History Musium Bern, Online at http://wsc.nmbe.ch, Version 2015; 16(5),
22. Zhang ZQ. The natural enemies of *Aphis gossypii* (Homoptera, Aphidiidae) in china //J. Appl. Entomol. 1992**;** 114:251-262.