



Argiope pulchella Thorell, 1881 (Araneidae: Araneae): A potential synanthropic species

Sangeeta Das*, Nilutpal Mahanta, Jatin Kalita

Department of Zoology, Gauhati University, Assam, India

Abstract

Species living in close association with human being acquire direct or indirect benefits from them. Altered landscapes due to anthropogenic activities create new microhabitats for species that cohabits with human. Such species occurs at high disturbance level but may or may not act as synanthropic species. *Argiope pulchella* Thorell 1881, commonly known as garden orb weaver is widely distributed in Assam. This paper attempts to recognise *A. pulchella*, as a potential synanthropic species. We recorded a total of 67 *A. pulchella* in the study area of which 90% of adults, 86% of sub adults and 83% of juveniles were found in human altered habitats types such as roadside drains and domestic sewage, garbage dump areas, roadside areas, forest areas, forest edge and garden areas. The study reveals that *A. pulchella* generally established in peri-domestic habitats which qualifies this species as a synanthropic species which tend to closely associate with human.

Keywords: *Argiope pulchella*, synanthropic species, Assam, India

1. Introduction

Alteration of landscape due to anthropogenic activities has resulted in reduction of size of natural or semi-natural habitats [1]. This in turn has created new microhabitats which provides opportunities for the existence of several species, which otherwise could not cohabit with human [2]. Spiders that live in close association with human are rarely regarded as the topic of interest by arachnologist [3]. On the basis on of selection of breeding sites, spiders can be classified as true synanthropes and partial synanthropes. True synanthropes generally establish their breeding populations inside houses whereas partial synanthropes which are found near human settlements but do not establish their breeding populations inside houses [4]. From India, study on spiders that occurs in and around human settlements as typical synanthropes was first reported by Sudhikumar *et al.* 2003 [4]. This is the only work on synanthropic spiders of India. They reported the presence of 30 species of synanthropic spiders which included only one species of Araneidae family, *Cyrtophora citricola*. Taucare-Rios *et al.* 2013 [1] reported *Argiope argentata* as a synanthropic species in Chile and Brazil and *Argiope trifasciata*, a synanthropic in Chile, U.S.A and Cuba. *Argiope pulchella* Thorell 1881, commonly known as garden cross spider [5] is abundantly found in Kamrup (M) district, Assam. This paper attempts to establish *A. pulchella* as a potential synanthropic species which is widely distributed in our study area, yet concentrated in peri-domestic habitats.

2. Methods and Materials

2.1 Study area

Kamrup metropolitan district is a highly populated district of Assam, India. This district is a perfect amalgamation of urban and rural areas. This district (1527.84 km²) is located at 26°11'0"N latitude and 91°44'0"E longitude of Assam. It embraces evergreen, semi-evergreen, deciduous forests,

grasslands including riparian forests and swamps. Annual rainfall ranges between 1500-2600 mm, average humidity of 76%, maximum temperature 37-39°C and min temperature of 6-7°C [6].

2.2 Sampling

The study area was gridded using QGIS ver. 2.10 and Google Earth Pro ver. 6.2. A total of 15 grids (4x4 sq. km) were surveyed by random sampling method. Within each grid, survey was conducted using visual search within belts transects of 1km length and 5 m on either sides. Survey was done for 3 age class: adult, sub-adult and juvenile from 8:00 am to 12:00 noon and from 1:00pm to 3:00 pm from 2014 to 2017. Individuals of *A. pulchella* were sampled and were studied to find out their microhabitat structure in different habitat types. Broadly on the basis of presence or absence of anthropogenic activities we categorized two basic habitat types: disturbed habitat (human altered habitat) and undisturbed habitat (forest areas with least or no impact by human activities). The disturbed habitats were further classified on the basis of human activities into 5 sub categories (Table 1).

3. Results

A total of 67 *A. pulchella* were studied of which we encountered 20 adults, 11 sub adults and 36 juveniles. Different stages of *A. pulchella* spiders were widely distributed in all the habitat types of disturbed habitat and undisturbed habitat category. Juveniles were found 83% in disturbed and 17 % in undisturbed areas and the Sub-Adults were found 86% in disturbed and 24 % in undisturbed areas. Adult spiders were to largely concentrate around disturbed habitats 90% and 10% in undisturbed habitats (Fig.1). High abundance of adult spiders (40%) were near Roadside drains and domestic sewage followed by garbage dump areas (30%),

roadside areas (10%), forest areas(10%) and forest edges (5%) (Fig. 4). Sub- adult spiders were also found highest near Roadside drains and domestic sewage (36%), garden area (22%) followed by relatively equal distribution in garbage dump, forest and forest edges (Fig.3). Juveniles stages were abundantly found in garden areas (25%) and fairly similar abundance in roadside drains and garbage dump areas (22%), followed by 17 % in Forest area and 8% around forest edges (Fig.2). *A. pulchella* was found to occupy higher in peri-domestic habitats, areas around human settlements. This orb weaving spider used several substrates for web constructions of which shrubs (36%) and climbers (24%) contribute a significant portion. Artificial substrates such as outer corners of walls of houses, bamboo poles and half constructed buildings constitutes 6% of the total substrates used (Fig.5).

4. Discussion

The study reveals that *A. pulchella* though widely distributed in the study area, prefers to occur more in disturbed habitats such as garbage dumps, drains and sewage, maintained garden areas and forest edges. One probable reason for occurrence of such a predator in these disturbed habitats may be the presence of food in fairly large quantity. *A. pulchella* is an entomophagous predator that preys on a wide range of insects. Untreated sewage and clogged drains support many groups of insects, formation of forest edges due to forest fragmentation from human settlements, etc. harbors many insect fauna. These predators are therefore very important in suppressing

insect populations to a lower level. *A. pulchella* was found to inhabit in peri-domestic habitats rather than inside houses. Usage of artificial structures i.e. outer walls of houses reveals they may sometimes come in close contact to humans but generally prefers to maintain distance to a large extent. Our study also reveals that juvenile stage of *A. pulchella* was found in almost every habitat type to lesser or greater extend. This may be due to the high dispersal behaviour that occurs during juvenile stage shortly after emergence from the egg sac [7]. At the adult stage this species tend to find suitable habitats near human settlements or forest edges. Since web is the only means for an orb weaver to encounter prey, web site selection thus, would have important consequences with terms of spider's fitness [8]. They can also dynamically adjust their webs in accordance to the type of prey active in the environment [9]. Venner and Casas (2005) [10] stated that spiders cannot survive or produce eggs without catching large preys. Their work gives us an indication that selection of site in terms of foraging efficiency is very crucial for egg laying. Though *A. pulchella* usually do not lay eggs or build webs inside human occupied houses, yet they prefer to choose sites outside in gardens, areas near household sewage outlets, near roadside vegetation and drains and near forest edges. This qualifies *A. pulchella* as a synanthrope, but more clearly as a partial synanthrope species only. This is in consensus with Taucare-Rios, 2013 [1] where *A. argentata* and *A. trifasciata* were reported to occur only in peri-domestic, agro-ecosystems and rural zones.

Table 1: Criteria for disturbed habitat categorization

Habitat type	Description (Based on anthropogenic activities)
1. Garbage dump	Garbage dump along roadside
2. Roadside drains and domestic sewage	Outlet areas of household sewage, Seasonal/perennial drains
3. Forest edge	Areas on forest edges
4. Roadside areas	Areas along roadsides with/ without vegetation but without garbage/ drains /sewage.
5. Garden area	Managed garden area

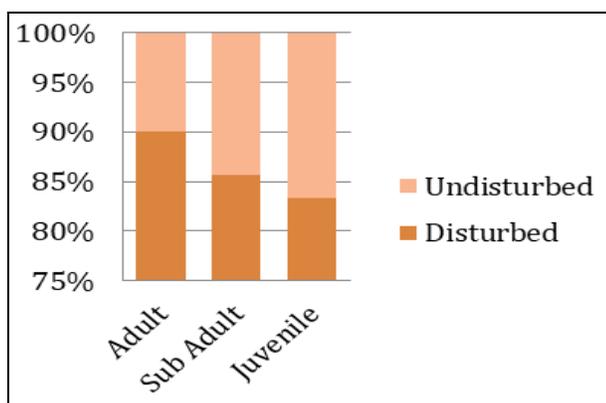


Fig 1: Chart showing relative proportion of disturbed and undisturbed habitat types used by juvenile, sub-adult and adult stages of *A.pulchella*

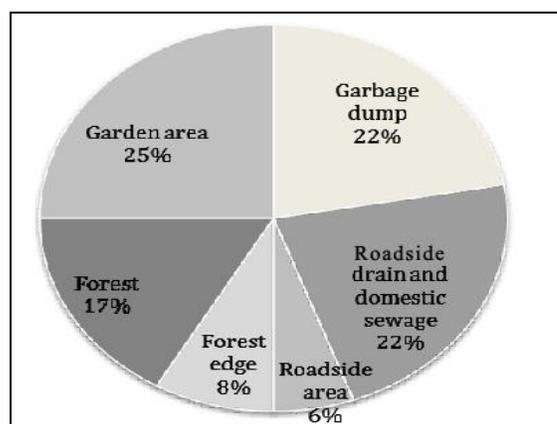


Fig 2: Relative abundance of juvenile *A.pulchella* in different habitat types.

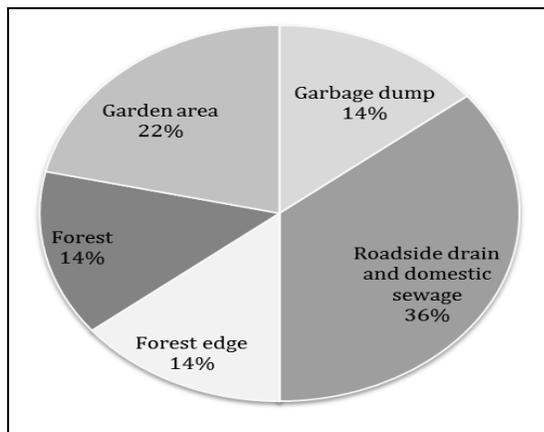


Fig 3: Relative abundance of sub-adult *A. pulchella* in different habitat types

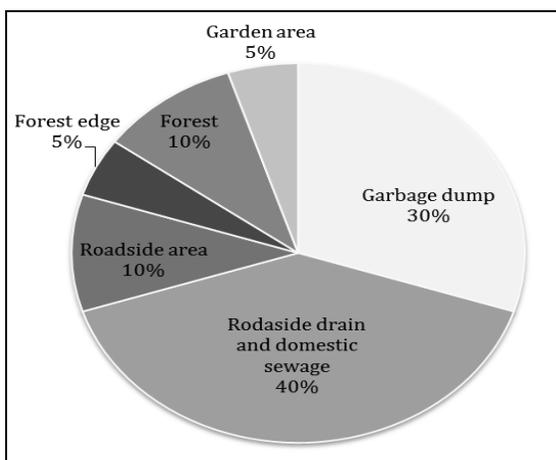


Fig 4: Relative abundance of Adult *A. pulchella* in different habitat types

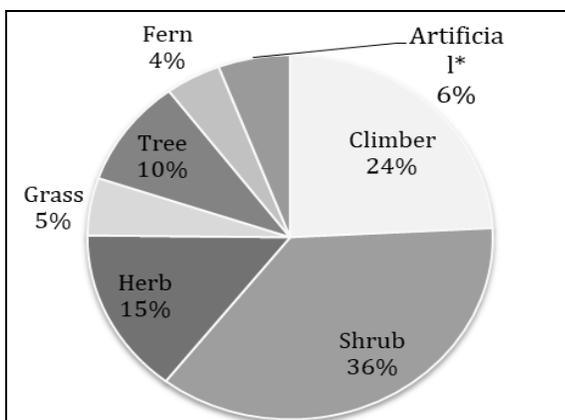


Fig 5: Relative proportion of different type substrates for building webs by *A. pulchella*. *Artificial substrate like outer walls of houses, poles, etc.

5. Conclusion

Synanthropic species are very essential to regulate insect populations as they tend to establish successfully at human modified habitats and maintain some distance from humans. Additionally, they cannot be regarded as pest since they do not establish breeding populations inside houses nor they affect

any human cultivated crops, instead their entomophagy nature can help to reduce insect pest population under control. Therefore maintaining such species in and around human settlements would be beneficial.

6. Acknowledgment

Our special thanks to Department of Zoology of Gauhati University and UGC-BSR for aiding us with laboratory and equipments. We also show deep sense of gratitude to Assam State Biodiversity Board for permitting us for conducting the field study.

7. Reference

1. Taucare-Ríos A, Brescovit A, Canals M. Synanthropic spiders (Arachnida: Araneae) from Chile. *Revista Ibérica de Aracnología*. 2013; 23:49-53.
2. Durán-Barrón CG, Francke OF, Pérez-Ortiz TM. Diversidad de arañas (Arachnida: Araneae) asociadas con viviendas de la ciudad de México (Zona Metropolitana). *Rex. Mex. Biodivers*. 2009; 80(1):55-69.
3. Rozwalka R. Spiders (Araneae) of the selected synanthropic environments in Lublin city. *Fragm. Faun*. 2006; 49(1):57-68.
4. Sudhikumar AV, Mathew MJ, Sunish E, Sebastian PA. Synanthropic spiders of Kerala, India. *Science and Technology for Sustainable Development*, 2006; 1:27.
5. Sebastian PA, Peter KV. *Spiders of India*, 2009; Universities press.
6. <http://kamrupmetro.in>. 20 March, 2017.
7. Tolbert WW. Aerial dispersal behavior of two orb weaving spiders. *Psyche*. 1997; 84(1):13-27.
8. Hodge MA. Factors influencing web site residence time of the orb weaving spider, *Micrathena gracilis*. *Psyche*. 1987; 94(3-4):363-372.
9. Herberstein ME. *Spider behaviour: flexibility and versatility*. Cambridge University Press, 2011; pp 57-86.
10. Venner S, Casas J. Spider webs designed for rare but lifesaving catches. *Proc. R. Soc. B*. 2005; 272:1587-1592.