

Effect of Seasonal Variations in Grasshopper Diversity at Selected High and Low Range Areas

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Abstract

The present study on grasshopper diversity at two areas (Kattappana at Idukki District and Pala at Kottayam District) were conducted during the period of monsoon and summer seasons. Total of 15 species belonging to 4 families were recorded during the study period. Family Acrididae has the maximum species diversity (10). It was followed by family Tettigoniidae which included 3 species. One rare species *Chromacrispitta cuspacifius* was recorded. While comparing the seasonal variations, the monsoon season showed high species diversity than the summer season in both the areas. The high range area (Kattappana at Idukki District) showed the greater species diversity than the low range area (Pala at Kottayam District) in both the seasons. Landscape alteration, forest fires, cattle grazing and use of pesticides were the major detrimental factors that threatening the diversity of grasshoppers.

Keywords: *diversity, grasshopper, high range area, seasonal variation*

1. Introduction

Grasshoppers are hemimetabolous insects of the suborder Caelifera which comes under the order Orthoptera which includes crickets and their allies in the suborder Ensifera. They are the oldest living group of chewing herbivorous insects, observed from the early Triassic around 250 million years ago. The powerful hind legs of these ground dwelling insects enable them to escape from threats by leaping vigorously. Some grasshopper species can change color, behavior and form swarms at high population densities under certain environmental conditions. Under these circumstances they are known as locusts. Grasshoppers had a long relationship with humans. Swarms of locusts can have devastating effects which cause famine and even in smaller numbers, the insects can be serious pests. They are used as food in countries such as Mexico and Indonesia.

Grasshoppers could be called the very base of the food chain in its ecosystem due to the wide array of secondary consumers that use it as a staple food source. They benefits the environment by feeding creatures like spiders, birds, lizards and more allowing them to survive and fulfill their own role in maintain a healthy, vibrant ecosystem (Kemp *et al*, 1990). According to the U.S department of Agriculture, grasshoppers generally consume 10 percent of available plants biomass- or even more. This means that the grasshopper plays a vital role in preventing plant overgrowth in the environment (Akhtar *et al*, 2012).

Even though grasshoppers can do significant damage to farmer's crops; they play a critical role in the environment, making it a safer and more efficient place for plants and other animals to thrive. Even a change in grasshoppers mood can alter the ways in which it benefits the environment. The grasshopper benefits humans and the ecosystem in general by facilitating plant decomposition, regrowth and creates a balance between the types of plants that thrive (Kirby *et al*, 1914). The study conducted by "Yale university" reveals how a mood based changes to a grasshoppers diet effect the environment around it. When a grasshopper dies, microbes in the soil easily breakdown its nitrogen rich body, enrich the soil and helps carbohydrate rich plants to grow (Jayne *et al*, 2015). Just like any other insect or animal grasshopper excrete waste after eating. These excreta are highly beneficial for fertilizing the soil and facilitating plant growth. In a field of a half- dozen bovins create large piles of excrement that microbes slowly breakdown to fertilize the soil. In that same field hundreds of grasshopper are also producing excrement and in much smaller amounts (Akhtar *et al*, 2012). The death and molting of a grasshopper provides extremely valuable minerals that can be naturally returned to the soil. Once the grasshopper molts or dies the minerals which normally remain locked into the grasshopper's exoskeleton armor, become available for the breakdown by plants rooted in the soil

(Herbert *et al*, 1982). While considering the significance of grasshoppers we have conducted a study on the diversity of grasshoppers at Kattappana which is a high range area and Pala which is a low range area. Also we have analyzed the seasonal variations of grasshoppers in these areas.

2. Materials and methods

The two sites selected for the study comes under two districts Kottayam and Idukki. One of the selected area, Kattappana lies at Idukki district where the temperature is low. The site in Idukki becomes a high range area which is rich in diversity. Second area, Pala at Kottayam district is a low range area where temperature is high.

Study was conducted in the months of June, July and August (2017) in the monsoon season and January, February and March (2018) in the summer season. Observations were done with naked eye and grasshoppers were collected by hand picking method and using insect net. They were identified with the help of identification key provided by Kirby, 1994.

3. Result and discussion

In the present study, 15 species of grasshoppers were recorded from the study area and they belong to different families such as Acrididae, Phrygomonphidae, Tettigonidae and Gryllacrididae. Species like *Melanoplus differentialis*, *Oxyafus covitatta*, *Oxya japonica*, *Romaleami croptera*, *Arphia conspersa*, *Anacridium aegyptium*, *Eritettix simplex*, *Schistocerca shoshone*, *Trilophidia sp* were belongs to Acrididae (9 species) family. Phrygomonphidae family recorded 3 species, Tettigonidae family have 2 species. The Gryllacrididae species include in Gryllacrididae family. Acrididae family shows high species diversity (9 species). A study on the “Species diversity and abundance of grasshopper fauna in rice ecosystem” by Humayoon in 2002, showed 85% of species were belong to the Acrididae family which was common in every area. In present study, site I and site II also showed the same result, that is Acrididae family showed highest number of species (9) in Kattappana and 6 species in Pala. *Chromacrispsitta cuspacificus* was a rare species recorded in the study area Kattappana, during the monsoon season.

Table 1: Comparison of grasshopper diversity during summer and monsoon season in low range area

| SL NO: | SPECIES | SUMMER SEASON | | MONSOON SEASON | |
|--------|----------------------------------|-----------------------------|-----------|-----------------------------|-----------|
| | | Total number of individuals | Abundance | Total number of individuals | Abundance |
| 1 | <i>Atractomorpha crenulate</i> | 28 | 11.9 | 66 | 9 |
| 2 | <i>Oxya japonica</i> | - | - | 125 | 17 |
| 3 | <i>Corpus aquatium</i> | 86 | 36.5 | 116 | 15.8 |
| 4 | <i>Melanoplus differentialis</i> | - | - | 30 | 4 |
| 5 | <i>Duceitia japonica</i> | 16 | 6.8 | 45 | 6.14 |
| 6 | <i>Arphia conspersa</i> | 64 | 27.2 | 58 | 7.9 |
| 7 | <i>Eritettix simplex</i> | 41 | 17.4 | 50 | 6.8 |
| 8 | <i>Schistocerca shoshone</i> | - | - | 68 | 9.2 |
| 9 | <i>Romalea microptera</i> | - | - | 125 | 17 |
| 10 | <i>Trigonomorpha unicolor</i> | - | - | 49 | 6.6 |
| | TOTAL | 235 | | 732 | |

Table 2: Comparison of grasshopper diversity summer and monsoon season in high range area.

| SL NO. | SPECIES | SUMMER SEASON | | MONSOON SEASON | |
|--------|---------------------------------------|-----------------------------|-----------|-----------------------------|-----------|
| | | Total number of individuals | Abundance | Total number of individuals | Abundance |
| 1 | <i>Atractomorpha crenulate</i> | 21 | 4.1 | 23 | 1.9 |
| 2 | <i>Oxya japonica</i> | 91 | 17.7 | 115 | 9.7 |
| 3 | <i>Corpus aquatium</i> | - | - | 127 | 10.7 |
| 4 | <i>Melanoplus differentialis</i> | - | - | 122 | 10.3 |
| 5 | <i>Duceitia japonica</i> | 101 | 19.7 | 104 | 8.8 |
| 6 | <i>Arphia conspersa</i> | 27 | 5.2 | 45 | 3.8 |
| 7 | <i>Eritettix simplex</i> | 66 | 12.8 | 98 | 8.3 |
| 8 | <i>Schistocerca shoshone</i> | 68 | 13.2 | 75 | 6.3 |
| 9 | <i>Romalea microptera</i> | 46 | 8.9 | 79 | 6.6 |
| 10 | <i>Oxyafus covitatta</i> | 64 | 12.5 | 106 | 8.9 |
| 11 | <i>Anacridium aegyptium</i> | 28 | 5.4 | 29 | 2.4 |
| 12 | <i>Chromacris psittacus pacificus</i> | - | - | 69 | 5.6 |
| 13 | <i>Nymph of gryllacrididae</i> | - | - | 86 | 7.2 |
| 14 | <i>Trilophidia sp</i> | - | - | 102 | 8.6 |
| | TOTAL | 512 | | 1180 | |

The most abundant species in low range area was *Corpus aquatum* (28) and *Ducetia japonica* (19) in high range area. The altitude is an important factor in the diversity of grasshoppers. During monsoon season 14 species were observed in high range area (Kattappana), from low range area (Pala) only 10 species were observed. In summer season, 9 species were observed in high range area (Kattappana) but only 7 species in low range area (Pala). The altitude will also affect the total number of individuals also. The total number of individuals observed in the Kattappana and Pala during monsoon was 1180 and 732 respectively. The total number of individuals changes from 512 to 235 in the summer season in the corresponding two sites (Table 1 and 2). The high range area (Kattappana) showed high grasshopper diversity in both summer and monsoon seasons, than in Pala (Figure 1 and 2)

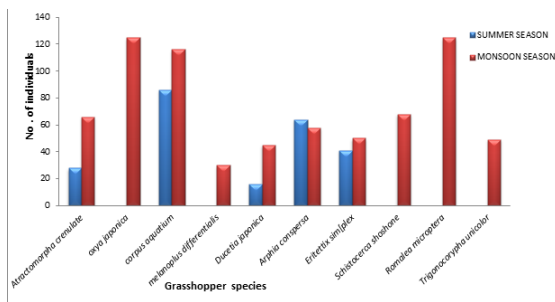


Fig 1: Species Diversity in the Monsoon and Summer Seasons in Low Range Area

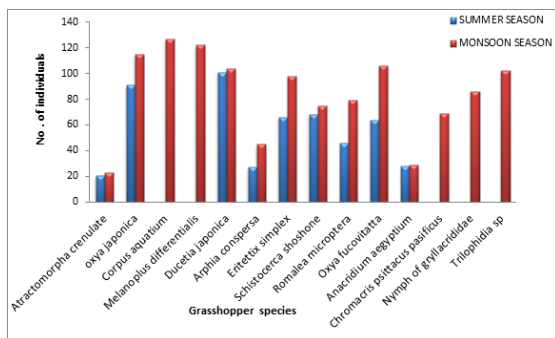


Fig 2: Species Diversity in the Monsoon and Summer Seasons in High Range Area

Seasonal variation is another very important factor that affecting the diversity. During monsoon season, 14 species were reported from high range area (Kattappana), but in summer season, it reduced to 9 species. A corresponding decrease was also observed in low range area Pala, i.e., 10 species during monsoon season and only 7

species were recorded during the summer season (Figure 3&4). The reduction in grasshopper diversity during the summer season may be due to the change in the vegetation structure which is caused by the seasonal variation. Climate change is one of the main threats to the grasshoppers. During the summer season high temperature will affect egg hatching process and the number of progenies will be reduced, and the seasonal variation will affects their food availability also.

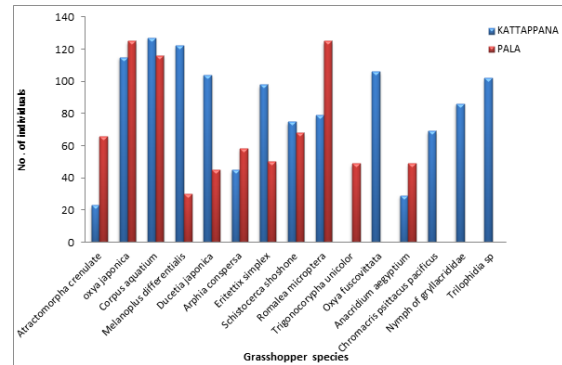


Fig 3: comparison of grasshopper diversity in high range and low range area during monsoon season

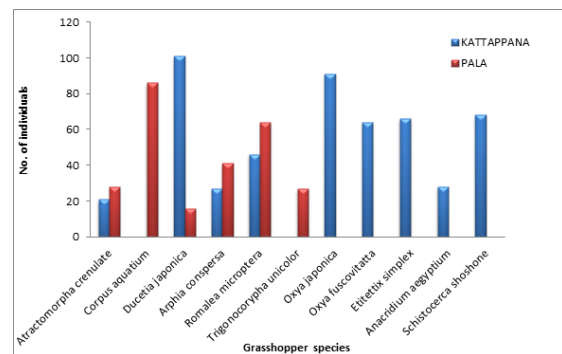


Fig 4: Comparison of grasshopper diversity in high range and low range area during summer season

4. Conclusion

The high range area exhibited highest diversity of grasshoppers during the study period. Since monsoon season reported most species diversity it is one of the most suitable seasons for grasshopper diversity. Grasshoppers are very important insects in the grassland ecosystem. They play a crucial role in the food chain and ecosystem quality. They prevent over growth of plants. Their droppings are rich in nitrogen and which fertilize the soil.

5. References

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