International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 06-07-2023, Accepted: 22-07-2023, Published: 07-08-2023
Volume 8, Issue 8, 2023, Page No. 1-6

A study on the diversity of grasshoppers at howly area, barpeta, Assam, India

Shajed Ali Ahmed[1*], Rakibul Islam[2]
[1] Department of Zoology, Assam Brilliant Academy, Simlaguri, Assam, India
[2] Department of Zoology, Shikha Jyoti Academy, Howly, Assam, India

Abstract
Grasshoppers, members of the Order Orthoptera, are an important component of terrestrial ecosystems, contributing to important ecological processes such as nutrient cycling and trophic interactions. The fundamental goal of this research is to evaluate the variety of grasshopper species in the Howly area, giving light on the hitherto unknown insect ecology in this location. We effectively discovered and recorded a varied variety of grasshopper species occupying various habitats throughout the study region using systematic field surveys and taxonomic identification procedures. During the systematic survey, 14 grasshopper species were discovered in the research region, divided into four families of the order Orthoptera (Acrididae, Tettigoniidae, Pyrgomorphidae, and Tetrigidae). Acrididae emerged as the most numerous of these families, with 7 different kinds and a total of 79 individuals. Following the Acrididae, the Tettigoniidae family had four variants and twenty individuals, while the Pyrgomorphidae family had two varieties and twenty people. Finally, the Tetrigidae family had one variation and seventeen individuals. These results contribute to a better knowledge of the local insect biodiversity and their ecological significance by providing useful insights into the richness and distribution of grasshopper species in the Howly region.

Keywords: Grasshoppers, orthoptera, pyrgomorphidae and tetrigidae

Introduction

Grasshoppers are intriguing insects that have established a worldwide presence, since they can be found in virtually all areas of the planet, ranging from the tropics to the polar regions. Grasshoppers may be found in almost every section of the world [1]. These adaptable animals have developed a niche for themselves in a wide range of environments, including mountainous terrain, grasslands, deserts, rainforests, and even aquatic territories [2].

Grasshoppers are split further into two suborders, which are known as Caelifera and Ensifera. Grasshoppers belong to the order Orthoptera [3]. They are distinguished from katydids, which may be identified by their notably longer antennae (Ensifera), by their popular name of short-horned grasshoppers, which belong to the order Caelifera. Egg, nymph, and adulthood are the three phases of development that hemimetabolous insects go through throughout their life cycle. Nymphs go through five different stages of moulting [4], each of which brings them closer to resemble an adult bug. It is interesting to note that under certain climatic circumstances and high population densities, some species of grasshoppers may undergo colour and behavioural changes, becoming known as locusts and forming swarms [5].

Due to the fact that grasshoppers consume predominantly plant matter, they serve an important role in a variety of food chains. Predators such as birds, spiders, and reptiles rely on them as an essential source of food supply [6]. Grasshoppers may be a big problem when they congregate in large numbers, particularly when they take the form of locusts. They can cause harm to a broad variety of crops, including grains, vegetables, and pastures, and they can spread disease. As a consequence of this, we classify them as oligophagous as well as mixed feeders [7].

In addition to the more than 20,000 recognised species in this order, India is home to over 1,750 known species of grasshoppers, showing the remarkable insect variety that exists in India [8]. These insects are an important link in the food chain, since they provide sustenance for a variety of birds and animals that live in the habitat. The dynamics of their population may have a significant influence on the trophic levels within the food chain, which can have repercussions for both predators and prey.

Grasshoppers have unique host preferences, which allows us to categorise them as either grass feeders (graminivorous), forb feeders (forbivorous), or ambivorous or mixed feeders (combining characteristics of both types) [9]. These bugs are classified under the insecta class, which is the most extensive subphylum under the arthropod phylum. Insecta are characterised by a number of similarities, including a chitinous exoskeleton, three body segments (head, thorax, and abdomen), three pairs of jointed legs, compound eyes, and one set of antennae. Insecta also have three pairs of legs [10].

Grasshoppers are classified as members of the superfamilies Acrididae and Pyrgomorphidae, which are found in the orders Orthoptera and Caelifera, respectively [11]. Pyrgomorphidae is also considered to be a different family and may be found all across India. On the other hand, the Acrididae family is comprised of a broad collection of representatives. Over 600 species belonging to 136 genera are categorised under the Acrididae family in India, although only 14 of the family's subfamilies have been uncovered so far [12, 13].

There hasn't been a lot of research done on grasshoppers, despite the fact that the Howly region of the Barpeta District in Assam has a substantial variety of them. This leaves a hole in the field of research. In order to fill this information gap, an exhaustive investigation of the grasshopper diversity

in the Howly area has been carried out. The results of this study have thrown light on the insect fauna that resides in this region.

Study area

Location and surroundings

The Howly area in Barpeta, Assam, India, stretches from a latitude of 26°5' to 26°49' and from a longitude of 90°39' to 91°17'. The range of these coordinates may be seen in the image to the right. The majority of this land is made up of a riverine plain that is located in the lower Brahmaputra valley and is bordered by Bhutan. The average elevation of the area is around 43 metres (141 feet) above the level of the mean sea.

Howly is a semi-urban area in the Barpeta district of Assam, and its name comes from the word "howly." The district offices at Barpeta are about 14 kilometres or 8.7 miles to the north of this location**.** The Barpeta railway station may be found to the north of the Howly region, while the district headquarters can be found to the south of this area. Bhawanipur, also known as Pathsala, can be found to the east, while Dewlipara, located on the Beki River, can be found to the west. Some of the places that people have chosen to make their homes in the Howly area include Ambari, Howly, Hatijana, Bagaijanpara, Mairamara, Barbarijar, Pashimhowli, Itervita, and Khandakarpara.

The climate of the Howly area is classified as somewhat subtropical, characterised by warm and dry summers (April through late May), a robust monsoon season (June through September), and cold and dry winters (late October through March). The year is divided into four distinct seasons, which are as follows:

The months of December through February make up the winter season. The months of March through May make up the pre-monsoon season. The months of June through September make up the monsoon/summer season. The months of October and November make up the post-monsoon season.

The average annual precipitation in this region is around 1975 millimetres, which is spread out across 77.3 days. June and July are the months that see the most precipitation overall throughout the year.

Temperature

Howly has an annual average temperature of roughly 24.5 degrees Celsius. The month of August has an average temperature of 28.8 degrees Celsius, while the month of January has an average temperature of 17.5 degrees Celsius. The warmest month is August.

Humidity

The average levels of humidity in the Howly area range anywhere from 45% to 75% of the time. In the Howly area, the most prevalent form of soil is alluvial soil, which has a characteristic that may be described as being sticky.

The Howly area is covered in its natural vegetation, which consists of a variety of plant species such as Thallophytes, Bryophytes, and Pteridophytes. Rice is grown in the agricultural fields almost exclusively during the pre-monsoon and monsoon seasons. However, during the post-monsoon and winter seasons, green vegetables, legumes, and mustard are produced, giving the area a verdant and lush appearance**.**

Materials and methods

The present study used a standardized approach to conduct the research. The materials and methods utilized in this investigation were carefully selected and implemented in order to ensure accuracy and reliability of the

Materials and Methods

A. Materials

The following materials were utilized in the study

1. Insect collecting net (Sweep Net)
2. Insect collecting jar
3. Cotton
4. Chloroform
5. Camera
6. Digital Caliper
7. Naphthalene
8. Entomological pin
9. Thermocol
10. Google Map
11. Compass app (for Latitude and Longitude)
12. Insect Display Box

B. Methodology

To examine the variety of grasshoppers, specimens were gathered from the Howly region in Barpeta, Assam. The data collection occurred bi-monthly within the designated region spanning from October 2022 to April 2023. Two scientific techniques, namely sweep netting and hand picking, were used for the purpose of capturing the grasshopper species.

1. Manual Selection

The grasshoppers were meticulously gathered by manual means and afterwards placed into storage vials or collecting jars with a solution of 70% alcohol. The use of this approach facilitated the effective sampling of a broad spectrum of habitats, hence enabling the collecting of a diversified array of grasshopper species.

2. Utilization of Sweep Netting

In order to collect invertebrates that inhabit fields, particularly arthropods such as insects that are either flying or perching on low plants, a sweep net was used. The sweep net, often constructed from a denser fabric such as white muslin or canvas, was systematically manoeuvred through the surrounding vegetation or over regions with water splashes near riffles, cascades, and waterfalls, using alternating backhand and forehand strokes. Sweeping activities were carried out at various intervals throughout the day and night in order to accommodate the diverse diurnal and nocturnal activity patterns shown by different invertebrate species.

3. Morphometric Analysis of Preservation

In order to investigate interspecific variance, the morphometry of four distinct body components (body length, pronotum, tegmina, and hind femur) was quantified in millimetres using a Vernier calliper. The mean values and standard deviations of the male and female specimens were computed. The pinned specimens were appropriately labelled with crucial details, such as the geographic

location, collection date, and host plant identification, prior to their placement in storage containers and cabinets for further analysis or recording. In order to inhibit the breakdown of dry specimens, naphthalene balls were used inside the boxes. Conversely, moist preservation included the utilisation of plastic vials containing 70% ethyl alcohol.

Results

Table 1: Grasshopper Species Diversity in Howly Area (Order: Orthoptera)

Species Name	Family	No. of Individuals
Oxya yezonsis	Acrididae	20
Oxya hyla hyla	Acrididae	15
Oxya chinensis	Acrididae	25
Phlaeoba infumata	Acrididae	15
Trimerotropis pallidipennis	Acrididae	9
Trilophidia annulata	Acrididae	6
Spathosternum prasiniferum	Acrididae	4
Concephalus semivittatus	Tettigoniidae	7
Concephalus nigropleurum	Tettigoniidae	12
Hexacentrus unicolor	Tettigoniidae	3
Euconocephalus pallidus	Tettigoniidae	2
Atractomorpha crenulata	Pyrgomorphidae	15
Atractomorpha similis	Pyrgomorphidae	5
Tetrix subulata	Tetrigidae	17

Table 2: Table for Random Survey

Time	Temperature Range (°C)
9:00 am - 11:30 am	25°C - 32°C
2:00 pm - 4:30 pm	25°C - 32°C

Table-1 and Figure 1 present the diversity of grasshopper species in the Howly area, categorized under the order Orthoptera. The table provides valuable information about different grasshopper species found in the study area, their respective families, and the number of individuals observed for each species during the survey.

In the course of the systematic study carried out in the Howly region, a comprehensive tally of 14 grasshopper species was documented. These species were classified into four families within the Orthoptera order, namely Acrididae, Tettigoniidae, Pyrgomorphidae, and Tetrigidae. The presented table provides information on the names of various species, their corresponding families, and the recorded count of individuals for each separate species.

The poll was conducted at two distinct time periods, namely from 9:00 am to 11:30 am and from 2:00 pm to 4:30 pm. The temperature observed during both survey sessions exhibited a variation between 25°C and 32°C.

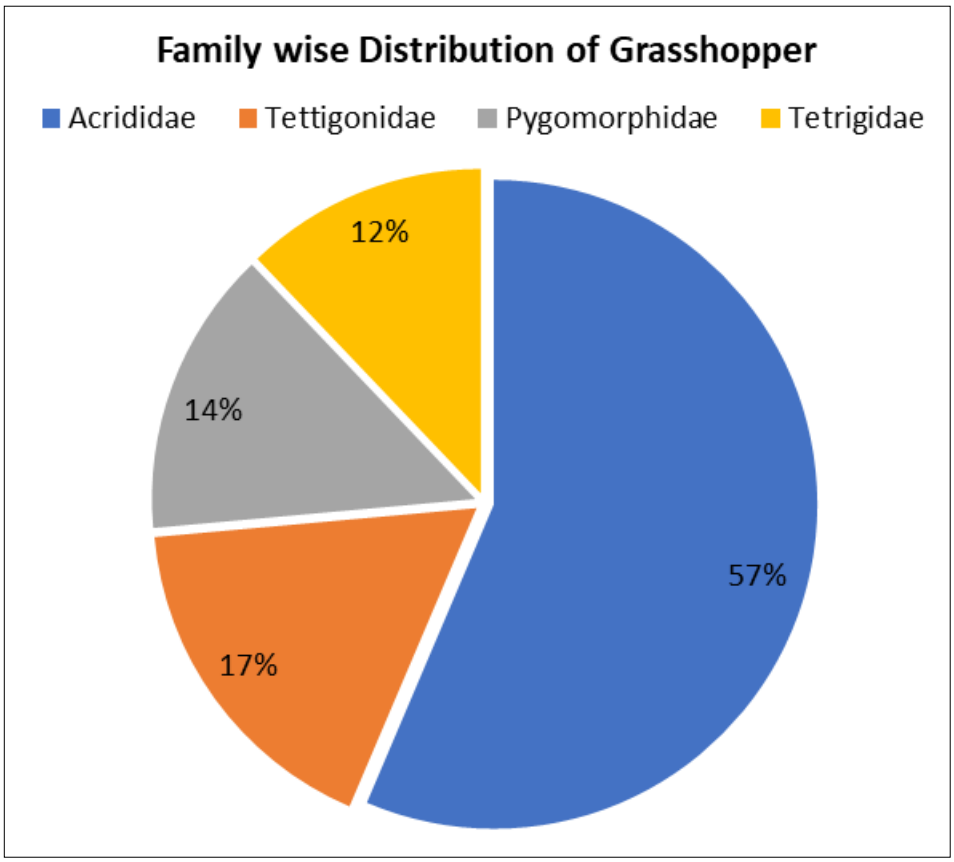

Fig 1: Showing No. of individuals of Grasshopper

A thorough study of grasshoppers in the Howly region revealed a total count of 140 grasshoppers, which were classified into four distinct families: Acrididae, Tettigoniidae, Pyrgomorphidae, and Tetrigidae. The findings of the survey revealed the following outcomes:

The family Acrididae had the most species variety, with a total of seven distinct species. Additionally, it boasted the largest population size, with a recorded count of 79 grasshoppers. The family Tettigoniidae exhibited four distinct species, with a cumulative count of 24 individuals detected within this taxonomic group. The Pyrgomorphidae family includes two distinct species, with a cumulative population size of 20 individuals. The Tetrigidae family consisted of a single known species, with a total population of 17 individuals.

The provided data offers significant insights on the diversity and abundance of grasshopper species in the Howly region, emphasising the prevalence of Acrididae in terms of both species diversity and population size. The survey enhances our comprehension of the community structure and spatial distribution of grasshoppers within the designated research area.

Table-2 and Figure 2 provides comprehensive data on the grasshopper species diversity in the Howly region, with a particular focus on the four families observed during the survey: Acrididae, Tettigoniidae, Pyrgomorphidae, and Tetrigidae.

Acrididae

The Acrididae family demonstrates the highest variety of species, with a total of 7 different species identified. Furthermore, it dominates in terms of population size, with a count of 79 individual grasshoppers belonging to this family.

Tettigoniidae

The Tettigoniidae family showcases 4 distinct species, and the number of individuals observed for this family amounts to 24.

Pyrgomorphidae

Within the Pyrgomorphidae family, 2 distinct species were found, comprising a total of 20 individuals.

Tetrigidae

The Tetrigidae family reveals 1 species identified, and the count of individuals belonging to this family reaches 17.

This table enhances our understanding of the grasshopper community within the Howly area, emphasizing the dominance of the Acrididae family both in terms of species diversity and population size. The information presented in this table proves valuable for further research and management strategies concerning the grasshopper population in this region.

Table 3: Comprehensive data on the grasshopper species diversity in the Howly.

Sl. No.	Family	Verities no of family	Number of individuals
1	Acrididae	7	79
2	Tettigonidae	4	24
3	Pygomorphidae	2	20
4	Tetrigidae	1	17

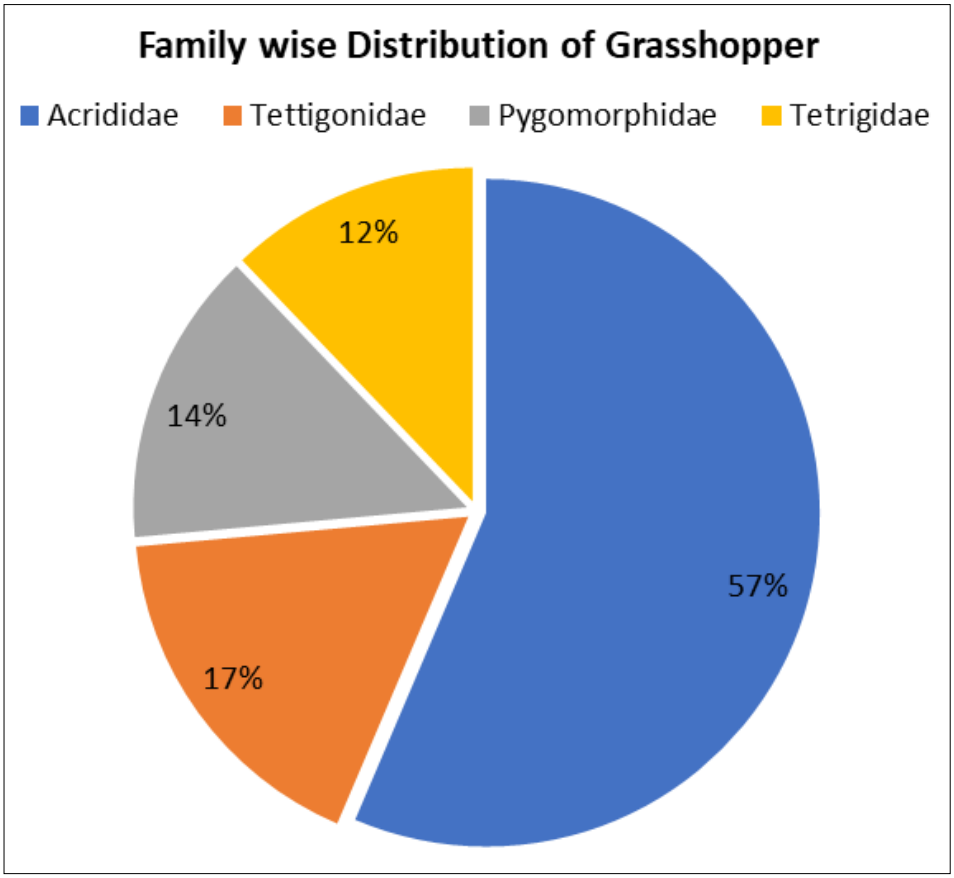

Fig 2: The family wise Distribution of Grasshopper

Discussion

The present study highlights the diversity and ecological significance of grasshoppers in the Howly area of Barpeta District, Assam. The region's geographical location, climate conditions, and vegetation composition create a suitable habitat for various grasshopper species to thrive. The dominance of the Acrididae family suggests its adaptability and preference for the local ecological conditions.

Grasshoppers' vital role in plant decomposition, soil enrichment, and natural fertilization underscores their ecological significance in the ecosystem. By understanding their behavior and ecological preferences, we can implement effective conservation measures to preserve their diverse populations and promote a healthy and balanced environment in the Howly area [14]. This research serves as a valuable resource for future studies and conservation efforts

aimed at safeguarding grasshopper diversity and ecological integrity in the region.

The objective of this study is to provide a comprehensive understanding of the grasshopper biodiversity in the Howly area of Barpeta District, Assam. The existence of a wide array of grasshopper species may be ascribed to the interaction of several factors, including as the geographic location, climatic circumstances, and plant composition prevalent in the area [15]. The data obtained from this study may be considered a valuable resource for understanding the habitat ecology, behavioural tendencies, and climatic preferences of several grasshopper species in the specified geographic region.

Grasshoppers are arthropods that are easily noticeable and have diverse impacts, which may be either advantageous or destructive, on their surrounding ecosystem. The present study included the identification of a total of 14 grasshopper species belonging to four distinct families, namely Acrididae, Tettigoniidae, Pyrgomorphidae, and Tetrigidae [16]. The family Acrididae had the highest species diversity and abundance compared to the other families investigated, indicating its prominent ecological presence within the studied area.

Grasshoppers have a crucial ecological role within their own surroundings, hence providing noteworthy contributions to the general well-being and balance of ecosystems. They play a role in facilitating the process of plant degradation and subsequent regeneration, hence forming a mutually beneficial connection among different plant species [17]. Following the death of grasshoppers, the decomposition process of their corpses is hastened by soil microbes, resulting in the breakdown of their nitrogen-rich composition. This procedure facilitates the improvement of soil quality, hence promoting the growth of plants that are rich in carbohydrates. In addition, the waste generated by these organisms functions as a good organic fertiliser, so offering further assistance to the growth and maturation of plants [18].

Conclusion

This research emphasises the ecological importance and diverse nature of grasshoppers in the Howly region of Barpeta District, Assam. The habitat suitability for diverse grasshopper species to flourish in the area is influenced by factors such as its geographical location, climatic conditions, and plant composition. The prevalence of the Acrididae family indicates its capacity for adaptation and inclination towards the specific ecological circumstances of its habitat.

The ecological relevance of grasshoppers in the environment is underscored by their crucial involvement in plant breakdown, soil enrichment, and natural fertilisation. By comprehending the behavioural patterns and ecological preferences of the species in question, it is possible to apply conservation strategies that are efficient in safeguarding their varied populations and fostering a state of well-being and equilibrium within the Howly region. The present study is a significant contribution to the field, offering vital insights for future investigations and conservation initiatives focused on preserving the variety of grasshoppers and maintaining ecological integrity within the studied area.

References

1. Chapman RF, Joern A. Biology of grasshoppers: John Wiley & Sons, 1991.
2. Lomer C, Bateman R, Johnson DL, Langewald J, Thomas M. Biological control of locusts and grasshoppers. Annual review of entomology,2001:46(1):667-702.
3. Sun H, Zheng Z, Huang Y. Sequence and phylogenetic analysis of complete mitochondrial DNA genomes of two grasshopper species Gomphocerus rufus (Linnaeus, 1758) and Primnoa arctica (Zhang and Jin, 1985) (Orthoptera: Acridoidea). Mitochondrial DNA,2010:21(3-4):115-31.
4. Hemp C, París M. A new species of Apteroscirtus Karsch, 1891 (Ensifera, Tettigoniidae, Mecopodinae) from Angola, 2021.
5. Athar T, Fatima H, Waris AA, Kanwal N, Majid F. Locust Attacks on Crop Plants and Control Strategies to Minimize the Extent of the Problem. Locust Outbreaks: Apple Academic Press, 2024, 119-43.
6. Reynolds S. A descriptive analysis of the link between riparian vegetation and insect species abundance and diversity: California State University, Sacramento, 2022.
7. Rayaguru N, Lindsay NM, Crespo RG, Raja S. Hybrid bat–grasshopper and bat–modified multiverse optimization for solar photovoltaics maximum power generation. Computers and Electrical Engineering,2023:106:108596.
8. Le Gall M, Overson R, Cease A. A global review on locusts (Orthoptera: Acrididae) and their interactions with livestock grazing practices. Frontiers in Ecology and Evolution,2019:7:263.
9. Guan H, Zhang S, Yang N, Huangpu Y, Lan B, Nikas KJ, *et al*. Parasitic flies alter the dietary preference of grasshoppers. Integrative Zoology, 2023.
10. Zhu Y, Ma Q, Zhong Z, Jiang M, Bakker ES, Harvey JA, *et al*. Contrasting effects of nitrogen fertiliser application on the performance of closely related grasshoppers through changes in plant nutrient concentrations. Ecological Entomology,202:48(3):347-57.
11. Knapp M, Dvořák T. Oviposition preferences in temperate grasshoppers: Conserved temperature requirements but contrasting responses to humidity across species, 2023.
12. Subedi M, Bhaskar D. Grasshoppers (Orthoptera, Acrididae & Pyrgomorphidae) of Ghyalchok, Gorkha, Nepal and four new species records. Journal of Insect Biodiversity and Systematics,2023:9(3):591–622-591–622.
13. Usmani MK, Usmani S, Naz H. Taxonomic studies on the gaudy grasshoppers (Orthoptera: Pyrgomorphoidea: Pyrgomorphidae) from the northeastern states of India. Journal of Threatened Taxa,2018:10(15):12953-68.
14. Whiles MR, Charlton RE. The ecological significance of tallgrass prairie arthropods. Annu Rev Entomol,2006:51:387-412.
15. Branson DH, Joern A, Sword GA. Sustainable management of insect herbivores in grassland ecosystems: new perspectives in grasshopper control. Bioscience,2006:56(9):743-55.
16. Koli Y, Bharmal D, Aland S, Patil S, Bhawane G. Orthopteran fauna of Chandoli national park,

Maharashtra. Lake 2010: Wetlands, Biodiversity and Climate Change, 2010.
17. Gonçalves F, Carlos C, Crespo L, Zina V, Oliveira A, Salvação J, *et al*. Soil arthropods in the douro demarcated region vineyards: General characteristics and ecosystem services provided. Sustainability,2021:13(14):7837.
18. Ahirwar NK, Singh R, Chaurasia S, Chandra R, Ramana S. Effective role of beneficial microbes in achieving the sustainable agriculture and eco-friendly environment development goals: a review. Front Microbiol,2020:5:111-23.