A study was carried out to understand the distribution pattern of assemblages, abundance and diversity of different arthropod taxa at agriculture fields of Hadgil Haruthi village which is a totally rain dependant area for cultivation. It is located 10km away from South west of Kalaburagi city. Gulbarga district is renamed as Kalaburagi District on November 1, 2014. The study was conducted over a 24 month period starting from January 2013 to December 2014.

3.1. Study Area:

Kalaburagi district is one of the 30 districts of Karnataka state in southern India (Figure 3.1). It lies in the northern part of Karnataka between 76°.04’ and 77°.42 east longitude, and 17°.12’ and 17°.46’ north latitude, with a geographical area of 10,951 km². The entire district is on the Deccan Plateau, and the elevation ranges from 300 to 750 m above MSL. The district is bounded on the west by Bijapur district and Solapur district of Maharashtra state, on the north by Bidar district and Osmanabad district of Maharashtra state, on south by Yadgir district, and on east by Ranga Reddy district and Medak district of Telanganna state. Kalaburagi district has semi-arid type of climate. The southwest monsoon sets in the middle of June and extends till the end of September. Bulk of the annual rainfall occurs during this season, which constitutes over 78% of the annual rainfall. Significant rainfall occurs during the winter monsoon owing to northeastern monsoon, which constitutes 9% of the annual rainfall. Dry climate prevails for most part of the year. December is the coldest month with mean daily maximum and minimum temperatures being 29.5°C & 15° to 10°C respectively. During peak summer, temperature shoots up to 45°C. Two main rivers, Bhima and Kagina, flow in the district. Black cotton soil is predominant soil type in the district.
3.2. Agriculture and crops:

The total cultivated area in Kalaburagi district is 12.55 lakh hectares, out of which kharif area is 6.66 lakh hectares and Rabi area is 5.89 lakh hectares. The district normally has three cropping seasons namely (Report of Government of Karnataka, Contingency plan for Drought Relief Work, 2003) kharif, Rabi, and summer. The source of irrigation is mostly canal system under Upper Krishna Project and rest through medium irrigation project and to some extent by bore well and tank irrigation. The (major) principal crops grown in the district are tur, bajra, ground nut, sunflower and rabi jowar and chickpea. Sugarcane is also grown to an extent of 7000 hectares. Red gram is the single monocrop, occupying the highest area in the state and in the country. Hence, Kalaburagi is popularly known as “RED GRAM BOWL OF SOUTH INDIA”.

The district has a total of 2, 41,482 small and marginal farmers. The district is economically backward with 80 percent of the population depending upon the agriculture. Most of the families reside in villages. The Kalaburagi district has a long history of continuous droughts. The only major irrigation project in the district is Upper Krishna Project, which covers 3 talukas, namely, Shahapur (Yadgir district), Shorapur (Yadgir district) and Jewargi (Kalaburagi district), providing irrigation to 1.96 lakh hectares of land. The other medium irrigation projects are Chandrampalli in Chincholi taluka covering 4010 hectares, Hattikuni, and Soudagar projects in Yadgir district covering 3,500 hectares. At present, out of total cultivated area only 18 per cent is under irrigation. With the completion of ongoing irrigation projects like Bennethora, Gandorinala and Amarja, the area under irrigation will be increased to 35 per cent cultivable area. The remaining cultivated area totally depends on rainfall only.
3.2.1. Description of agriculture field:

The present work is carried out in agriculture fields of Hadgil Haruthi village which is totally rain dependant for cultivation, located 10km south west of Kalaburagi city. Three micro-habitats are selected for the study purpose in the agriculture field (Figure 3.2). The three micro-habitats are as follows

1. Agro-habitat (AGH): In this habitat Kharif and Rabi crops are cultivated across the year.
2. Perennial Habitat (PRH): This habitat is surrounded by mango trees (*Magnifera*) and neem trees (*Azadirachta indica*).
3. Dry land Habitat (DLH): In this habitat there is no cultivation of crops, its absolutely dry land surrounded by throne trees (*Acacia*) and grasses (*Poaceae*).
3.3 **Seasonal study description:**

The seasonal study of Arthropods taxa has been studied with in and between the selected three micro habitats, for the purpose of study the season has been divided into premonsoon (February to May), monsoon (June to September) and postmonsoon (October to January).
PLATE-1: AGRO-HABITAT
PLATE 2: PERENNIAL HABITAT
PLATE 3: DRY LAND HABITAT
3.4 Meteorological data:

The meteorological data of Kalaburagi with reference to mean temperature, relative humidity and rainfall from January 2013 to December 2014 is obtained from the Indian Meteorological Department, Bangalore. The data is represented in the following. (Table 3.1 & 3.2)

**Table 3.1: Meteorological data of Gulbarga from January 2013 to December 2013.**

<table>
<thead>
<tr>
<th>MONTH</th>
<th>Temperature (°C)</th>
<th>Mean Relative Humidity</th>
<th>Total rainfall (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum</td>
<td>Minimum</td>
<td>08.30hrs</td>
</tr>
<tr>
<td>January</td>
<td>33.2</td>
<td>18.3</td>
<td>66</td>
</tr>
<tr>
<td>February</td>
<td>34.1</td>
<td>19.8</td>
<td>67</td>
</tr>
<tr>
<td>March</td>
<td>38.1</td>
<td>22.7</td>
<td>50</td>
</tr>
<tr>
<td>April</td>
<td>40.4</td>
<td>25.2</td>
<td>56</td>
</tr>
<tr>
<td>May</td>
<td>41</td>
<td>26.7</td>
<td>63</td>
</tr>
<tr>
<td>June</td>
<td>33.6</td>
<td>22.3</td>
<td>86</td>
</tr>
<tr>
<td>July</td>
<td>29.7</td>
<td>21.7</td>
<td>91</td>
</tr>
<tr>
<td>August</td>
<td>31.1</td>
<td>21.9</td>
<td>86</td>
</tr>
<tr>
<td>September</td>
<td>32</td>
<td>22.1</td>
<td>87</td>
</tr>
<tr>
<td>October</td>
<td>32.8</td>
<td>22.4</td>
<td>83</td>
</tr>
<tr>
<td>November</td>
<td>31.8</td>
<td>19.2</td>
<td>73</td>
</tr>
<tr>
<td>December</td>
<td>31.2</td>
<td>15.8</td>
<td>77</td>
</tr>
</tbody>
</table>

**Table 3.2 : Meteorological data of Gulbarga from January 2014 to December 2014.**

<table>
<thead>
<tr>
<th>MONTH</th>
<th>Temperature (°C)</th>
<th>Mean Relative Humidity</th>
<th>Total rainfall (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum</td>
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<td>33.6</td>
<td>19.2</td>
<td>64</td>
</tr>
<tr>
<td>March</td>
<td>36.1</td>
<td>22.7</td>
<td>60</td>
</tr>
<tr>
<td>April</td>
<td>40.2</td>
<td>25.7</td>
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<tr>
<td>May</td>
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<tr>
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<td>32.4</td>
<td>23.5</td>
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</tr>
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<td>67</td>
</tr>
<tr>
<td>December</td>
<td>30.8</td>
<td>16.9</td>
<td>65</td>
</tr>
</tbody>
</table>
3.5. Methodology:

The study was conducted over 24 month period starting from January 2013 to December 2014. The collection of arthropods and insects were carried out monthly wise. The traps were set up randomly in selected habitat. Four sampling methods were used for the collection of different arthropod taxa.

3.5.1. Sampling methods:

3.5.1.a Pitfall trap:

Pitfall traps are the most frequently used method for sampling surface-dwelling arthropods. This method estimates relative arthropod activity rather than absolute density, reflecting individual abundances of species and movement rates within a given habitat. Current literature shows that pitfall traps can be used in a variety of ways: to evaluate the distribution of ground dwelling arthropods in diverse ecosystems at different scales, to describe activity patterns, habitat associations as well as to establish relative species abundances, or the effects that disturbance can have on biodiversity. Pitfall trap sampling is one of the easiest and least expensive methods for collecting large numbers of macroinvertebrates. Pitfall trap is a passive method.

Surface-dwelling arthropods were sampled using pitfall traps during the year January 2013 to December 2014. The traps were set up early morning and kept over night, after 24 hours the traps were retrieved. A total 1440 traps i.e 60 traps per month were placed through out the study period in three micro habitats of agriculture fields randomly (i.e each habitat 20 traps per month). Each pitfall trap consisted of a single 1000-ml-capacity plastic cup (top diameter = 12 cm, height = 14 cm) buried so that the top was flush with the ground surface and filled to a depth of 2 cm with a dish washing soap and water solution to prevent escape by captured invertebrates. Collected specimens were preserved; dry pinned or preserved in 70% ethanol as required and sorted upto order level taxa initially. Later the specimens were identified with the help of relevant experts in the field.
3.5.1.b Sweep net :

Sweep net collection is a active method. Sweep net sampling was done from the herb and shrub layers of the vegetation using a sweep net. This method is specially suited for sampling insects from ground layer vegetation. The sweeps were done during the morning hours while walking in the agriculture fields present within the study area. The insects collected in the sweeping were temporarily transferred in polythene bags and plastic bottles. Later they are taken to the laboratory and killed using ethyl acetate. These insects were stretched, pinned and preserved.

3.5.1.c. Hand collection :

Hand collection is also active method. Insects were directly collected by hand and transferred in killing bottles. The insects were processed for pinning and preserved in wooden insect box in dry condition.

3.5.1.d. Yellow pan trap :

Yellow pan trap is a passive method for insect collection. Many day-active insects are attracted to the colour yellow. The traps were set up early morning and kept over night and were retrieved after 24 hours the traps. This trapping method uses small yellow shallow dishes/plates filled with water mixed with a little detergent. The dishes are placed on the ground in study area during the morning hours. When flying insects land on the surface of the water they rapidly sink and drown. Next day, the water is strained through a fine sieve and the specimens are retrieved. The specimens were preserved in 70% alcohol. Later the specimens were sorted order-wise and sent for identification to the experts.

3.6. Statistical Analysis:

3.6.1 Measurement of Diversity:

The type of diversity used here is $\alpha$- diversity which is the diversity of species within a community or habitat. The number of taxa is represented by ‘$S$’ and total number of individuals is represented by ‘$n$’.
3.6.1.a. Shannon-Wiener Diversity index: A diversity index, taking into account the number of individuals as well as number of taxa. Varies from 0 for communities with only a single taxon to high values for communities with many taxa, each with few individuals.

\[ H = - \sum P_i \ln P_i \]

where \( P_i = S / N \)

\( S = \) number of species
\( N = \) total number of individuals
\( \ln = \) logarithm to base e

3.6.1.b. Dominance = 1 - Simpson index. Ranges from 0 (all taxa are equally present) to 1 (one taxon dominates the community completely). Where \( n_i \) is number of individuals of taxon i.

\[ D = \sum \left( \frac{n_i}{n} \right)^2 \]

where \( n_i \) is number of individuals of taxon i.
\( n \) is total number of individuals.

3.6.1.c. Simpson's Index (D) measures the probability that two individuals randomly selected from a sample will belong to the same species (or some category other than species).

\[ D = \frac{\sum n(n-1)}{N(N-1)} \]

\( n = \) the total number of individuals of a particular species
\( N = \) the total number of individuals of all species
The value of \( D \) ranges between 0 and 1

Simpson index 1-D: Measures 'evenness' of the community from 0 to 1.
3.6.1.d. Measurement of species richness:

Margalef’s index was used as a simple measure of species richness (Margalef, 1958).

\[
\text{Margalef’s index} = \frac{(S - 1)}{\ln N}
\]

\(S\) = total number of species

\(N\) = total number of individuals in the sample

\(\ln\) = natural logarithm

3.6.1.e. Measurement of evenness:

For calculating the evenness of species, the Pielou’s Evenness Index (e) was used (Pielou, 1966).

\[
\text{Pielou’s Evenness Index} e = \frac{H}{\ln S}
\]

\(H\) = Shannon – Wiener diversity index

\(S\) = total number of species in the sample

3.7 Legend used in results (tables and figures):

AGH - Agro-habitat.

PRH - Perennial habitat.

DLH - Dry land habitat.

PM – Premonsoon.

M – Monsoon.

POM – Postmonsoon.