

Acridid (Orthoptera) diversity of agriculture ecosystem from Solapur District of Maharashtra, India

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ABSTRACT

Diversity of Acridid (Orthoptera) was studied at the Solapur district in 2012-2013, Acridid Grasshoppers were collected by one man one hour search method at 15 days interval. Total 18 species from seven sub families were identified with their average population and studied distribution patterns also from different tahsils of Solapur district. Maximum species reported from Pandharpur, Mohal and Malshirous tehsil. Out of 18 species, *P. infumata* is dominant species. In overall observation maximum population of grasshoppers reported in Post monsoon period and minimum population in pre-monsoon period.

Key words- Acridid, Grasshopper, Diversity, Orthoptera.

INTRODUCTION

Diversity is the important natural resource of uncountable value; it gives the information regarding to current status of animal evolution, species richness, species abundance and other ecological information. Grasshoppers are one of the largest diverse groups of insects. They are functionally important being the dominant aboveground invertebrates in pastures and natural grasslands, when judged by biomass (Scott, et al. 1979), (Risser et al. 1981). Family Acrididae includes all locusts; they have tremendous power of migration. Acridid grasshoppers are primary consumer, they regulate several food chains also, play important role in nutrient recycling in forest ecosystem.

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Therefore, conservation of grasshoppers is highly needful in forest ecosystem. Once ecosystems are disturbed, population of particular group of animal may be increases or decreases. Low population of grasshopper's effect on food chain and High population of grasshoppers effect on rapid loss of vegetation cause increase runoff soil erosion and destruction of food sources of many animals. In balanced ecosystem have self-ability to maintain suitable level of population. Grasshoppers are recognized agriculture crop pest. Hence, nobody thinks about conservation of grasshoppers. Grasshoppers are found throughout the year, some species of grasshoppers are dominant in winter, some are in rainy, and some are in summer season. Species diversity mostly depends on climatic condition like temperature, rainfall, humidity, type of soil and type of vegetation. Acridid grasshoppers are exclusively Phytophagus, they feed on variety of vegetations, mostly prefer small surface vegetations, like different grasses, vegetables, pulses, cereals, and some species prefer plants also.

Acridid grasshoppers may be univoltain, bivoltain or trivoltain. Characteristics of soil are highly important on grasshopper's populations as they effect on oviposition, embryonic development and egg survival. Grasshopper mostly prefer porous soil for egg laying, eggs are lay in pods. Grasshoppers are classified as grass feeders (Gramivorus), forbs feeders (Forbivorous) or mix of the two (Ambhivorous or mixed feeders) (Isely-1944).

At National and International level following scientist contributed to Order- Orthoptera, Dwivedi (1978), Kirby (1914), Isely (1944), Bhowmik (1986) Suhail et al.(1999), Ingrisch and Gorai (2001), Chandra (2003), Smith & Capinera (2005), Song (2006), Branson and Sword (2009).

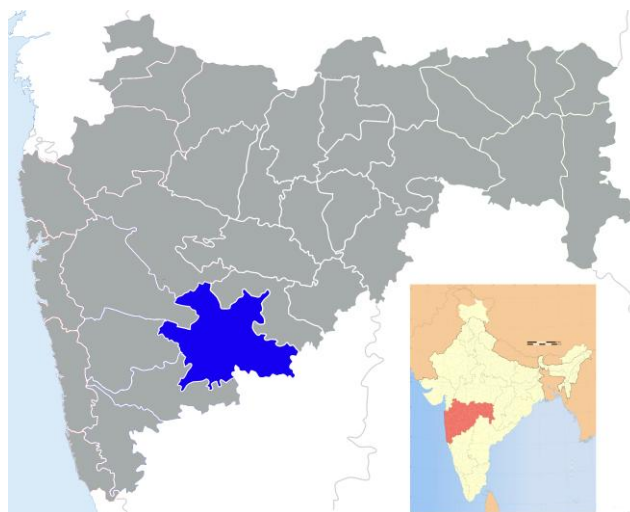
MATERIALS AND METHODS

Grasshoppers were collected from various agro ecosystems of Solapur district by one man one hour search method at 15 days interval. Observations were made on taxonomical features with the help of lens, compound microscope and later photographed. The collected common species were preserved for further study and Grasshopper-population index has made. Rare species of grasshopper were released where from they were collected.

Study Area

Solapur district geographically situated at 17° 04'N Latitude & 75° 54'E Longitude. Its elevation is 483.63 m above mean sea level. The mean annual rainfall at Solapur is 723.4 mm. The rainfall is scanty, erratic & ill-distributed. The rainfall during early karif season is uncertain and is coupled with prolonged dry spells. May is the hottest and December is the coldest month. In general the climate is "Semi-Arid". The farm represents the typical dry farming tract in its climatic & soil conditions. Soils are derived from basic igneous rock namely basalt (Deccan tract) & underlain with partially disintegrated rock locally Soils are base saturated, with calcium as the predominant material in the exchange complex. Lime concentrations are also met within the soil profiles. The soils are grouped into three broad categories according to the depth. Shallow soils (22.5 cm), account for about 20 %, medium deep (22.5 to 45 cm) 50 % and medium deep

(45-90 cm) 30 %. Soils are low in nitrogen, low to medium in available Phosphorus & high in available Potash. Vertisols and associated group soils are having adverse physical properties like high swelling and shrinkage, moderate rate of infiltration. (ZRS Solapur, [Map-1](#)).



Map-1. Study area-Solapur district, Maharashtra

RESULTS

Acridid grasshopper species distribution report recorded in [Table-1](#). Grasshoppers were reported from seven tahasils of Solapur districts. Total 18 species of Grasshopper were reported. *A. exaltata*, *p. infumata*, *A. thalassinus tamulus*, *G. africanus africanus*, *T. annulata*, *S. prasiniferum prasiniferum*, *H. banian*, *C. tatarica*, *X. humalis humalis*, and *E. alacris alacris* are well adapted in climatic condition of Solapur region because all these species reported from all seven tahasil. While, *T. indica*, *g. laticornis*, *D. desius*, *O. hyla hyla* and *O. japonica japonica* are not reported from Madha, Mangalvedha, Sangola and Barshi tahasil. All 18 species are reported in Pandharpur, Mohal and Malshirous, were diversity of grasshopper is good as comparative to other tahasil because, Bhima River is flowing through these tahasils as well as were good irrigation systems also available. Hence, well diversified cropping patterns also found were throughout the year. Madha, Mangalvedha, Sangola and Barshi tahasils has maximum period of year is dried also no permanent water bodies available were. Only rainy season were found diversified cropping

Table-1. Distribution of Acridid species from Solapur districts

No.	Name of Grasshoppers	Pandharpur	Malshirous	Madha	Mohal	Mangalvedha	Sangola	Barshi
	Subfamily-Acridinae							
1.	<i>Truxalis indica</i> Bol.	+	+	-	+	-	-	-
2.	<i>Acrida exaltata</i> Walker	+	+	+	+	+	+	+
3.	<i>Phlaeoba infumata</i> Brunner.	+	+	+	+	+	+	+
	Subfamily-Gomphocerinae							
4.	<i>Gelostorrhinus laticornis</i> (Serv.)	+	+	-	+	-	-	-
	Subfamily – Oedipodinae							
5.	<i>Doclostaurus desius</i> Walk	+	+	-	+	-	-	-
6.	<i>Aiolopus thalassinus tamulus</i> (Fabr.)	+	+	+	+	+	+	+
7.	<i>Gostrimargus africanus africanus</i> Sauss	+	+	+	+	+	+	+
8.	<i>Heteropternis respondens</i> (Walk)	+	+	+	+	+	-	-
9.	<i>Trilophidia annulata</i> (Th.)	+	+	+	+	+	+	+
	Subfamily Hemiacridinae							
10.	<i>Spathosternum prasiniferum prasiniferum</i> (Walk.)	+	+	+	+	+	+	+
11.	<i>Hieroglyphus banian.</i>	+	+	+	+	+	+	+
12.	<i>Oxya hyla hyla</i> (Th.)	+	+	-	+	-	-	-
13.	<i>Oxya japonica japonica</i> (Th.)	+	+	-	+	-	-	+
	Subfamily-Cyrtacanthacridinae							
14	<i>Cyrtacanthacris tatarica</i> (Linn.)	+	+	+	+	+	+	+
	Subfamily- Catantopinae							
15	<i>Catantops pinguis</i> Stal	+	+	-	-	+	+	+
16	<i>Xenocatantops humalis humails</i> (Serv.)	+	+	+	+	+	+	+
17	<i>Stenocatantops splendens</i> (Th.)	+	+	-	-	-	-	-
	Subfamily- Eprepocnemidae							
18	<i>Eyeprepocnemis alacris alacris</i> (Serve.)	+	+	+	+	+	+	+

pattern. Therefore, diversity of grasshoppers also pours as comparative to other tahasil.

In table-2 to 7 and Graph-1 to 5 shown that average population of Grasshoppers species are recorded. 18 species (Figure-1-18) from seven sub families are prevailing in the region of Solapur. Subfamily Oedipodinae is available with good diversity and population, below this sequentially Acridinae, Hemiacridinae, Oxyninae and Gomphocerinae are available were.

Species *T. indica*, *G. laticornis*, *H. respondance*, *A. thalassinus tamulus* and *H. banian* are found in rainy and winter season. *P. infumata*, *G. africanus africanus*, *T. annulata*

and *S. prasiniferum prasiniferum* are found throughout the year and dominant in Solapur region. *T. indica*, *A. thalassinus tamulus*, *D. decius* and *O. japonica japonica* species maximum population reported in month September and minimum in month January-February. *P. infumata*, *G. laticornis* and *T. annulata* species maximum population recorded in month November and minimum population of species *P. infumata* and *G. laticornis* recorded in month March while, *T. annulata* minimum population reported in month May- Jun. *A. exalata* maximum population reported in month August and minimum in March.

Table-1. Average population of subfamily Acridinae from Agricultural ecosystem of Solapur region.

Name of species	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
<i>T. indica</i>	0.33	0	0	0	0	0	0.33	1.66	1.66	0.66	0.66	0.33
<i>A. exaltata</i>	0.66	0.66	0.33	0	0	1.66	2	2	0.66	0.33	0.33	0.33
<i>P. infumata</i>	2.66	3	0	2.66	2.66	0.33	0.33	0.1.66	2.66	2.66	3	2.66

Table-3: Average population of Subfamily Gomphocerinae from Agricultural ecosystem of Solapur region

Name of species	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
<i>G. laticornis</i>	0.33	0.33	0	0	0	0	0.33	0.66	1.66	1.66	2.00	0.66

Table-4: Average population of Subfamily Oedipodinae from Agricultural ecosystem of Solapur region

Name of species	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
<i>H. respondes</i>	0.33	0	0	0	0	0	0.33	0.66	2	2.66	2	0.66
<i>G. a. africanus</i>	0.66	0.1	0.66	0.66	0.33	0.66	0.33	0.66	2	3	2	1
<i>A. thalassinus tamulus</i>	0.33	0	0	0	0	3	0.66	2	2	1.66	0.66	0.66
<i>T. annulata</i>	2	1	0.66	0.66	0.33	0.33	2	3	3	3.33	2.66	0.66
<i>D. decius</i>	0.33	0.33	0	0		0	0.33	0.66	2	1.66	0.66	0.66

Table-5: Average population of subfamily Hemiacridinae from Agricultural ecosystem of Solapur region

Name of species	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
<i>H. banian</i>	0	0	0	0	0	0	0.66	4	3	2.66	1.66	0
<i>S. p. prasiniferum</i>	0.66	0.66	0.33	0.33	0.33	0.66	4	4	3.33	3.33	3	2

Table-6: Average population of Subfamily Oxyninae from Agricultural ecosystem of Solapur region

Name of species	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
<i>O. hyla hyla</i>	0	0	0	0	0	0	0.33	0.66	1	1.66	0.66	0.66
<i>O. japonica japonica</i>	0	0	0	0	0	0	0.66	0.66	0.66	0.33	0.33	0

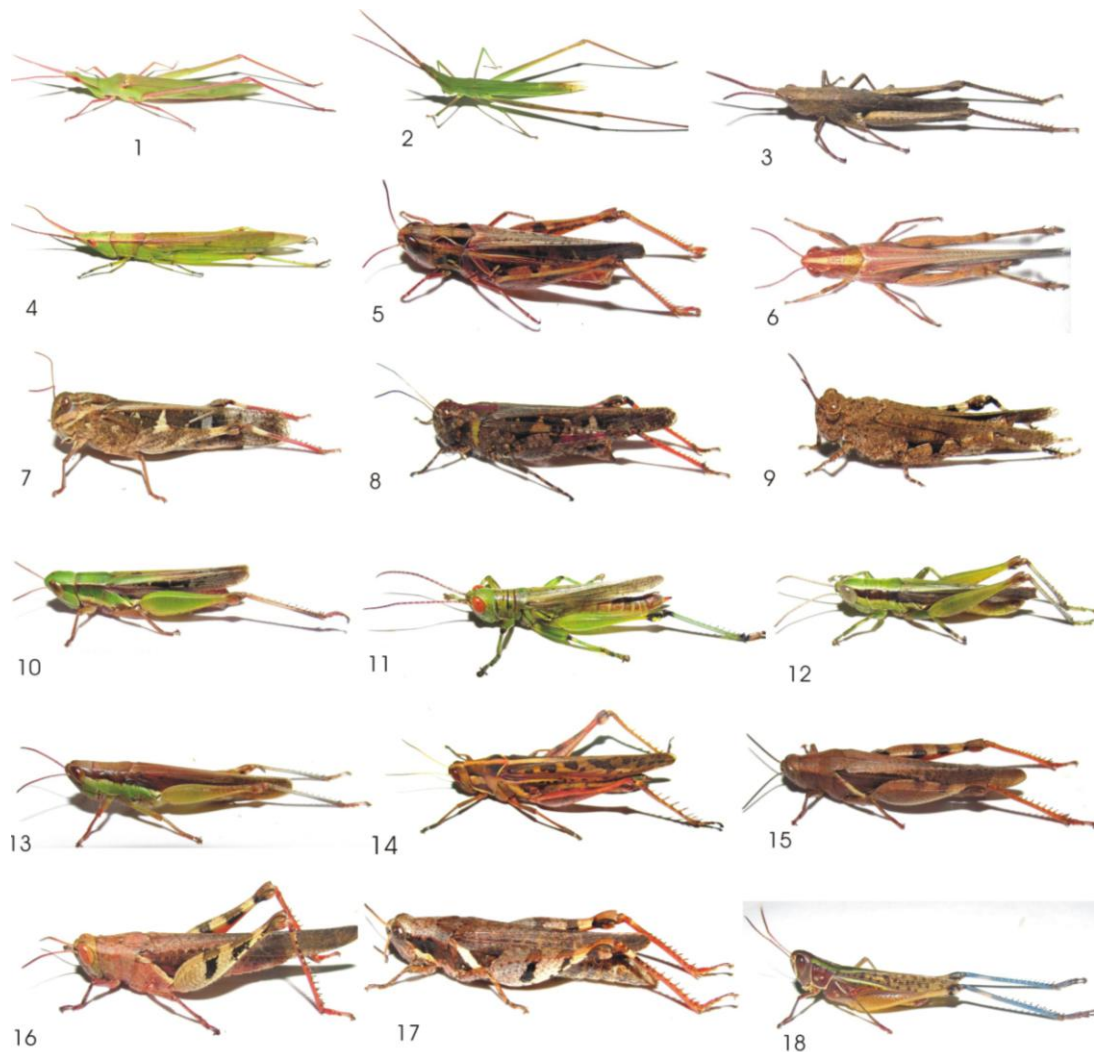
Figure.1-18. Diversity of Acridid Grasshoppers from Solapur region.

Fig.1: *T. indica*, Fig.2:*A. exaltata*,Fig.3:*P. infumata*, Fig.4 *G. laticornis*, Fig.5:*D. desius*,
 Fig.6:*A.thalasinus tamulus*, Fig.7: *G. aricanus africanus*, Fig.8 :*H. Respondens*,
 Fig.9: *T. annulata*, Fig.10: *S. prasiniferum prasiniferum*, Fig.11: *H. banian*,
 Fig. 12: *O. hyla hyla*, Fig.13: *O. japonica japonica*, Fig.14: *C. tatarica*, Fig.15: *C. Pinguise*,
 Fig.16:*S. splendence*, Fig. 17: *X. humalis humalis* , Fig.18: *E. alacris alacris*.

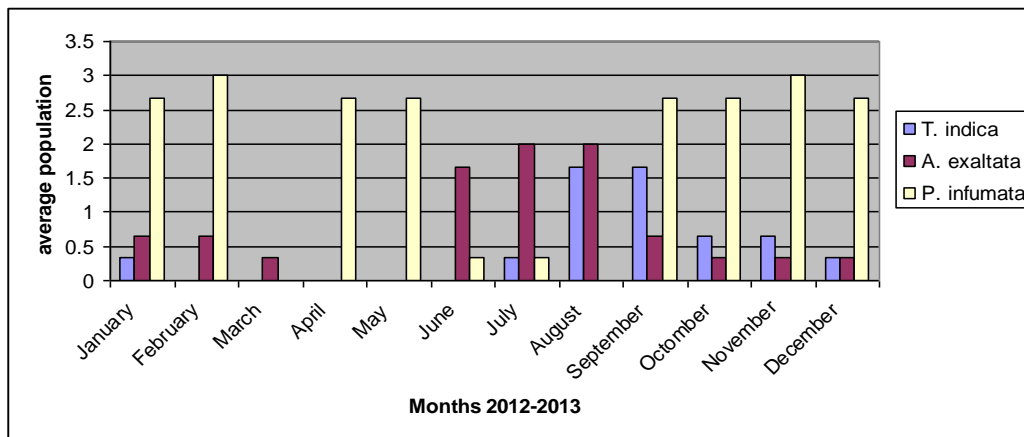
Out of all species *P. infumata* is dominant species. In overall observation maximum population of grasshoppers reported in Post monsoon period and minimum population in pre-monsoon period. In post monsoon period rich variety of vegetation available relatively grasshoppers population also rich in this period.

DISCUSSION

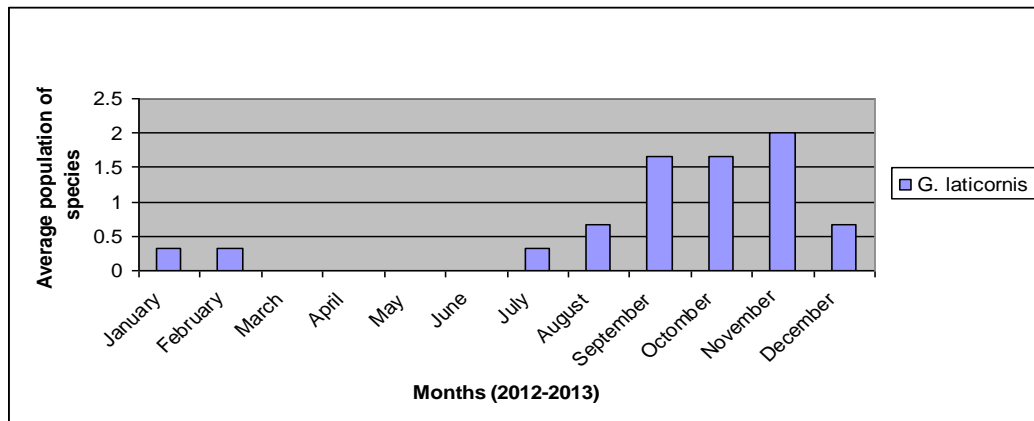
Order Orthoptera is non poisonous order. Recently T. V. Sathe et al. 2015. 27 poisonous insects have been reported from Kolhapur

region belonging to the orders Hymenoptera, Lepidoptera, Coleoptera, Hemiptera and Dictyoptera. Hymenoptera and Lepidoptera were dominant orders in the region. Hymenoptera represented by 11 species and Lepidoptera 9 while, Coleoptera, Hemiptera and Dictyoptera orders represented by 3, 2 and 2 species respectively. The insects were controlled by spraying 0.15% Carbaryl or 5% Diazinon or 0.5% Dichlorvos or 1.5% Baygon Symptomatic treatment has been advised with anti-allergic drugs and ayurvedic plant juices of tulsi, marigold and periwinkle as wound healing

Graph-1. Average population of subfamily Acridinae from Agricultural ecosystem of Solapur region



Graph-2. Average population of Subfamily Gomphocerinae from Agricultural ecosystem of Solapur region

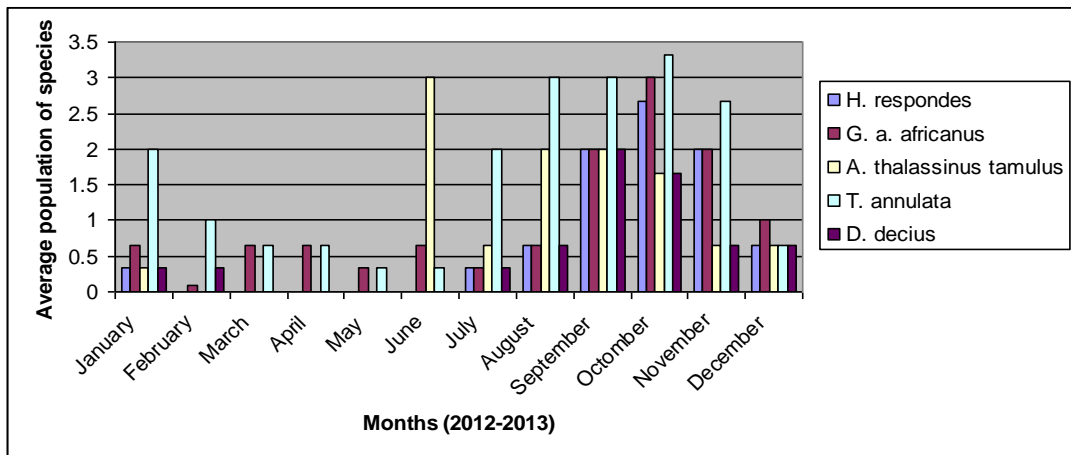


component. Gabriel Paulraj et al. (5009) Studied Distribution of Grasshoppers (Insecta: Orthoptera) among different host plants and habitats in two districts of Tamil Nadu. In a survey of grasshoppers from nine localities of northeastern Tamil Nadu, carried out from August 2004 to December 2006, 33 grasshopper species grouped under four families were recorded. Family Acrididae was found to be the predominant group of grasshoppers represented by 21 species, which was 63.6% of the total species collected. The acridids collected can be classified under seven subfamilies and 15 genera. Family Tettigoniidae was the second largest group represented by six species falling under five genera and three subfamilies, and this family contributed 18.2% to the total grasshopper species recorded in this study. Among the different habitats, grasses

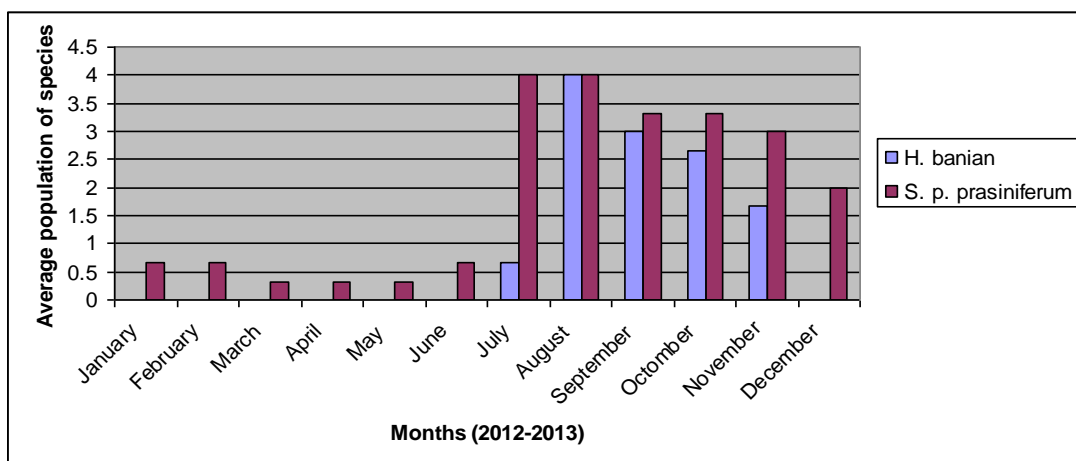
supported the highest number of 18 species (54.6%) while 11 species were surface grasshoppers. The painted grasshopper *Poecilocerus pictus* (Fab.) was collected from many plants viz., Calotropis, curry leaf, grass, groundnut, okra, and on ground. The maximum number of species was recorded from Manimangalam in Kancheepuram District during the entire study period.

Shishodia, et al. (2002) Made survey of Orthoptera from Pong dam wetland Kangara district, Himachal Pradesh. Were reported 39 species belonging to 35 genera, under 8 Families, belong super families Acridoidea, Tettigonioidae, and Grylloidea, Thakur et al. (2004) studied Orthopteran diversity from Roper Wetland, Panjab were reported 42 species belonging to 38 genera, under 12 Families, belong super families Acridoidea,

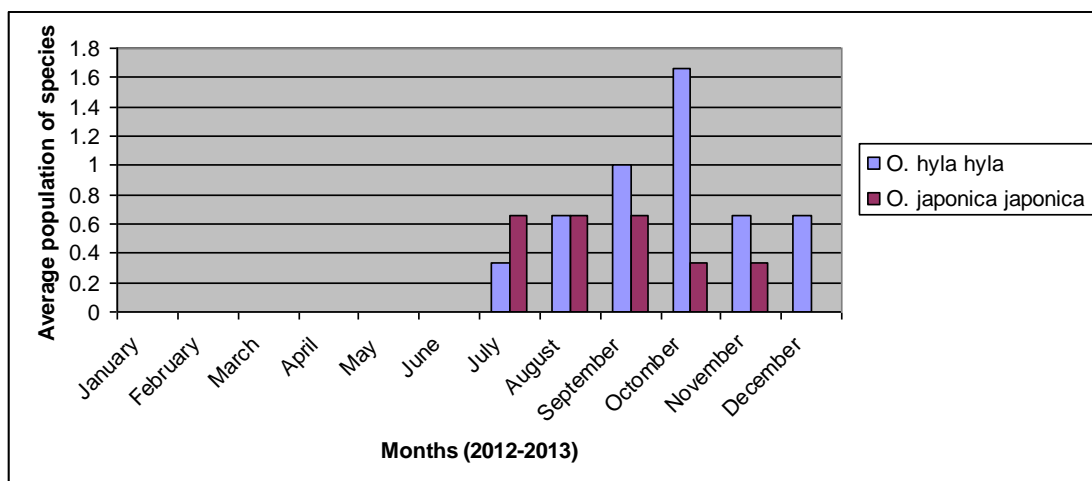
Graph-3: Average population of Subfamily Oedipodinae from Agricultural ecosystem of Solapur region



Graph-4: Average population of subfamily Hemiacridinae from Agricultural ecosystem of Solapur region



Graph-5: Average population of Subfamily Oxyinae from Agricultural ecosystem of Solapur region



Tettigoniodea, and Grylloidea. Mayya et al. (2005) Takes place a survey of grasshoppers form Dakshin Kannada Districts of Karnataka were reported twenty eight species of short horned grasshopper (Acridide) were recorded 250km² area from September 2000 to June 2002, the surveys in 12 localities indicated difference in diversity and density of grasshopper pointing to areas with anthropogenic influence, pollution and agriculture to be less diverse compared to disturbed and polluted areas.

D.Prabahakar et al. 2015. Studied Diversity of insecta: Orthoptera of Kanchipuram District in Tamil Nadu and prepare the checklist and diagnostic characters of Orthoptera of Kanchipuram district along with their known distribution which includes 12 species/subspecies of belonging to 9 genera under 2 Suborder, 3 Superfamilies, 3 families and 7 subfamilies. However, no such type Acridid diversity studied from Solapur region. Present work will add a great relevance to Grasshopper diversity of Solapur region.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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