



Distribution of Grasshoppers (Insecta: Orthoptera) among different host plants and habitats in two districts of Tamil Nadu, India

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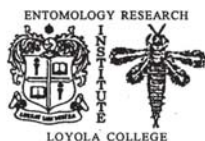
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Author contribution: The study was conducted by M. Gabriel Paulraj and V. Anbalagan under the supervision of Dr. Fr. S. Ignacimuthu; Paper was written by M. Gabriel Paulraj and S. Ignacimuthu.

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Abstract: In a survey of grasshoppers in 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 *Poeciloceris 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.

Keywords: Acrididae, grasshoppers, host plants,

Tamil Abstract

ஆய்வுச்சூழ்வுகள் : துறியூர் நூட்டிவன் வடகரீழ்க்குப் பகுதியில் 2004 ஆம் ஆண்டு அக்டோபர் மாதம் முதல் 2006 ஆம் ஆண்டு டிசம்பர் மாதம் முடிய ஒன்பது இடங்களில் நடத்தப்பட்ட ஒரு ஆய்வுக் கணக்கெடுப்பின் மூலம் மூப்பத்து மூன்று வெட்டுக்கள் சீற்றினங்கள் நூன்றூ குறும்பங்களின் கீழ் பதிவு செய்யப்பட்டன. இரூபத்தொன்று சீற்றினங்களை உள்ளடக்கிய அக்டிடிடே குறும்பமானது மொத்த சீற்றினங்களுள் 63.6 சதவீதம் அளவில் பெரும்பான்மையாக இருந்தது. இரூ ஆய்வில் சேகரிக்கப்பட்ட அக்டிடிடே வெட்டுக்கள்கள் ஏழு உட்குறும்பங்களாகவும் 15 பேர்னங்களாகவும் வகைப்படுத்தப்பட்டன. இரூ அநுத்துபடியாக பெரும்பான்மையாக பதிவு செய்யப்பட்டது வெட்டுக்கோண்டே குறும்பமாகும். இரூ குறும்பத்தில் 3 உட்குறும்பங்களாக சேர்ந்து ஐந்து பேர்னங்களில் ஆறு சீற்றினங்கள் 18.2 சதவீதத்தில் பதிவு செய்யப்பட்டன. புல் தூவரங்களையே அக்தமமாக 18 சீற்றினங்களுக்கு வாழ்விடமாக இருந்தது. இரூ அநுத்துபடியாக 11 சீற்றினங்கள் நிலத்தில் மேற்பகுதியில் சேகரிக்கப்பட்டன. வண்ண வெட்டுக்களையான *பிக்லோசெரஸ் பிக்டஸ்* அக்தமமான வாழ்விடங்களில் அரூவது எரூக்கு, கரீவேப்பணை, புல், ரூவக்கடனை, வெண்ணை தூவரங்கள் மற்றும் ரூவத்தின் மேற்பரப்பு போன்றவற்றில் காணப்பட்டது. காஞ்சீபுரம் மாவட்டத்திலுள்ள மணியங்கலம் கரூமத்திலிருந்து அக்தமமான வெட்டுக்கள் இரூனங்கள் பதிவு செய்யப்பட்டன.

INTRODUCTION

Grasshoppers are one of the largest and most 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). Some grasshoppers cause significant damage to tree seedlings (Joshi et al. 1999) and agricultural crops. They are also important components of the food chain for many birds and mammals (Capinera et al. 1997; Mayya et al. 2005), and hence resource management practices that alter grasshopper population dynamics will affect several trophic levels in the food chain (Capinera et al. 1997). Most grasshoppers are oligophagous and exhibit definite host preferences (Mulkern 1967), according to which grasshoppers are classified as grass-feeders (graminivorous), forb-feeders (forbivorous) or a mix of the two (ambivorous or mixed feeders) (Isely 1944). Host plant shifting may occur in grasshoppers when their main host is absent, and may indicate the removal of a particular plant species due to environmental degradation or urbanization. In recent years farmers have altered cropping patterns and agronomical practices due to urbanization, labour problems and a desire for greater profits. The changing scenario in agriculture is affecting primary consumers like grasshoppers and thereby creating impacts for entire food webs, thus it is necessary to study the distribution of grasshoppers in relation to their habitats and host plants. Previous studies conducted by Shrinivasan & Muralirangan (1992), Muralirangan et al. (1992), Sanjayan et al. (1995), Joshi et al. (1999), Kandibane et al. (2004) and Mayya et al. (2005) have added information on grasshopper fauna of different regions of India. The present study was undertaken to record grasshopper fauna from different host plants

and habitats in chosen localities in Kancheepuram and Thiruvallur districts of Tamil Nadu.

METHODS

Study Area: The survey of grasshopper fauna among different habitat types was conducted at nine different localities: Dhandarai, Kakillapettai, Manimangalam, Nungambakkam, Padappai, Parivakkam, Poonamallee, Thiruvallur and Vayalanallur in Chennai, Kancheepuram (11°00'-12°00'N & 77°28'-78°50'E) and Thiruvallur (12°15'-13°15'N & 79°15'-80°20'E) districts of Tamil Nadu. Except Nungambakkam, other localities are rural areas surrounded by agroecosystems. Nungambakkam (13°3'38"N & 80°14'4"E) is in the heart of Chennai city.

Host plants and habitats: Grasshoppers that were found feeding on host plants were collected from grasses, *Calotropis*, cotton, tapioca, brinjal, curry leaf, maize, rice, radish, castor and okra. In the Nungambakkam site grasshoppers were collected from cotton, tapioca, brinjal, curry leaf and okra that were cultivated in a one acre garden at the Entomology Research Institute, and from a one acre ground which contains grasses and *Calotropis* inside Loyola College Campus. Specimens were also collected from the ground surface inside the sampling sites. The area under cultivation in Dhandarai, Kakillapettai, Manimangalam, Padappai, Parivakkam, Poonamallee, Thiruvallur and Vayalanallur ranges from 15 to 30ha with different crops.

Sampling: In each habitat within a location, random sites were sampled monthly with a help of a sweeping net (25cm diameter). Grasshoppers were also collected by hand in the same sites.

Identification: Adult grasshopper samples were sorted to morphospecies and identified up to species level with the help of experts.

RESULTS AND DISCUSSION

A total of 33 species of grasshoppers were collected from different host plants and habitats, and 32 species were identified (Table 1). All the grasshoppers collected are classified under four families viz., Acrididae, Pyrgomorphidae, Tetrigidae and Tettigoniidae. Family Acrididae was the most dominant with 21 species of Acridids grouped under 15 genera of seven subfamilies, amounting to 63.6% of total collected species. This observation is in accordance with Capinera et al. (1997), Kandibane et al. (2004), Thakur et al. (2004) and Chandra et al. (2007). The second largest family was Tettigoniidae with five genera and three subfamilies, which contributed 18.2% (6 species) of the total collected species, while the Pyrgomorphidae ranked third with 15.2% of total species collected (5 species) with four genera but with only one subfamily. Tetrigidae was represented only by one species. The trend of numerical distribution of different grasshopper families recorded in the present study is similar to the observations of Andersen et al. (2000), who also reported that Acridid grasshoppers were the largest group followed by Tettigoniidae and Pyrgomorphidae in the Kakadu National Park, Australia.

In a study Muralirangan et al. (1992) have recorded 20 species of acridids under eight subfamilies in different parts of Tamil Nadu. Shrinivasan and Muralirangan (1992) have

recorded 18 acridids under four sub families in Tamil Nadu. They have recorded monocot and dicot plants as hosts for acridids. In the present study, seven subfamilies of acrididae have been recorded and they colonized in more diverse habitats such as grasses, groundnut, rice, tapioca, cotton, maize and brinjal fields and ground surface, suggesting that the Acridids are well adapted for colonizing different habitats and are capable of feeding and utilizing a wide range of host plants. Pyrgomorphids and tettigoniids were collected from seven and five habitats respectively. Among the different habitats, grasses were found to be the most common habitat for grasshoppers (54.5%) (Table 2). Capinera et al. (1997) found that the gramnivorous grasshoppers were the most abundant probably because secondary plant chemicals are largely absent from grasses (Bernays & Chapman 1978). Next to grasslands, more number of grasshoppers was collected from ground surface (33.3%) and groundnut (21.2%) ecosystem. Five species viz., *Acrida* sp., *Anacridium flavascens*, *Epistaurus sinetyi*, *Trilophidia annulata* and *Pyrgomorpha brachycera* were collected only from ground surface. The information on the type of food utilized by the ground grasshoppers could not be gathered in this study. Shelton & Rogers (1978) and Pfadt & Lavigne (1982) have reported that some grasshoppers feed on algae, fungi, detritus matter, humus and moss found on ground. Braker (1989) has reported that most of the grasshoppers, particularly the members of the superfamily Acridoidea lay eggs in soil. Hence the grasshoppers collected from the ground surface in the present study might be algal, detritous, humus or moss feeders or they might have come to the ground for egg laying.

The rice ecosystem supported four acridid species viz., *Aiolopus thalassinus tamulus*, *Catantopus pinguis innotabilis*, *Spathosternum prasiniferum prasiniferum* and *Truxalis indica* and one tettigoniid, *Euconocephalus pallides*, which constituted 15.2% of total grasshoppers collected. In the irrigated rice ecosystem in Madurai, Tamil Nadu, Kandibane et al. (2004) have collected 21 species of grasshoppers under three families such as Acrididae (71.4%), Tettigoniidae (23.8%) and Pyrgomorphidae (4.7%). They reported that *Oryza nititula* and *O. fuscovittata* were the common and dominant taxa in rice ecosystem. In the present study, these two species have been recorded but not in rice field.

Among the nine localities, maximum number of grasshopper species was collected from Manimangalam during 2004-2005 (22 species) and 2005-2006 (23 species). Least number of species was recorded from Nungambakkam during 2004-2005 (12 species) and 2005-2006 (10 species) (Figure 1). Mayya et al. (2005) have stated that anthropogenic activities and pollution affected the grasshopper diversity in Dakshina Kannada District, Karnataka. Hence, the low species richness in Nungambakkam might be due to the anthropogenic activities and pollution since it is located inside the city where automobile pollution is more.

In this study, 24 species (72.7%) were collected from only one type of habitat or host plant. This finding suggested that most of the grasshoppers are highly selective to host plants or habitats and it coincides with the statement of Mulkern (1967). According to him, most grasshoppers are selective to some degree, exhibiting definite plant preferences. Three species were collected from two types of habitats and six species were collected from more than two habitats. Among the different species, the painted grasshopper *Poekilocerus pictus*, a pyrgomorphid, was collected from many different host plants such as *Calotropis*, curry leaf, grass, groundnut and okra in

Table 1. Grasshopper species collected from different crops, weeds and adjacent habitats in two districts of Tamil Nadu

SNo	Species	Sub Family	Family	Habitat
1	<i>Acrida exaltata</i> (Walk.)	Acridinae	Acrididae	Grass
2	<i>Acrida</i> sp.	Acridinae	Acrididae	Soil
3	<i>Acrotylus humbertianus</i> Saussure	Oedipodinae	Acrididae	Groundnut
4	<i>Aiolopus thalassinus tamulus</i> (Fabricius)	Oedipodinae	Acrididae	Grass, rice
5	<i>Anacridium flavascens</i> (Fabricius)	Cyrtacanthacridinae	Acrididae	Soil
6	<i>Catantops pinguis innotabilis</i> (Walker)	Catantopinae	Acrididae	Grass, groundnut, rice, soil
7	<i>Catantops</i> sp.	Catantopinae	Acrididae	Grass
8	<i>Cyrtacanthacris tatarica tatarica</i> (Linn.)	Cyrtacanthacridinae	Acrididae	Tapioca
9	<i>Dnopherula</i> sp.	Truxalinae	Acrididae	Grass
10	<i>Epistaurus sinetyi</i> Bolivar	Catantopinae	Acrididae	Soil
11	<i>Epistaurus</i> sp.	Catantopinae	Acrididae	Grass
12	<i>Eyprepocnemis alacris alacris</i> (Serville)	Eyprepocnemidinae	Acrididae	Cotton
13	<i>Heteracris pulcher</i> (Bol.)	Eyprepocnemidinae	Acrididae	Maize
14	<i>Oxya fuscovittata</i> (Marschall)	Oxyinae	Acrididae	Grass
15	<i>Oxya hyla hyla</i> (Serville)	Oxyinae	Acrididae	Grass, soil, brinjal
16	<i>Oxya nitidula</i> (Walker)	Oxyinae	Acrididae	Groundnut
17	<i>Oxya</i> sp.	Oxyinae	Acrididae	Grass
18	<i>Phlaeobida</i> sp.	Truxalinae	Acrididae	Grass
19	<i>Spathosternum prasiniferum prasiniferum</i> (Walker)	Truxalinae	Acrididae	Rice
20	<i>Trilophidia annulata</i> (Thunberg.)	Oedipodinae	Acrididae	Soil
21	<i>Truxalis indica</i> (Boliver)	Truxalinae	Acrididae	Grassland, rice, brinjal
22	<i>Atractomorpha crenulata</i> (Fab.)	Pyrgomorphinae	Pyrgomorphidae	Brinjal, grass
23	<i>Orthacris</i> sp.	Pyrgomorphinae	Pyrgomorphidae	Grass, groundnut, Okra, soil
24	<i>Poekilocerus pictus</i> (Fabricius)	Pyrgomorphinae	Pyrgomorphidae	Okra, curry leaf, Grass, soil, Calotropis, groundnut
25	<i>Pyrgomorpha brachycera</i> (Walk.)	Pyrgomorphinae	Pyrgomorphidae	Soil
26	<i>Pyrgomorpha</i> sp.	Pyrgomorphinae	Pyrgomorphidae	Grass, soil
27	<i>Conocephalus</i> sp.	Conocephalinae	Tettigoniidae	Grass
28	<i>Elimaea</i> sp.	Phaneropterinae	Tettigoniidae	Groundnut
29	<i>Euconocephalus pallidus</i> (Redtb)	Copiphorinae	Tettigoniidae	Rice
30	<i>Euconocephalus</i> sp.	Copiphorinae	Tettigoniidae	Grass
31	<i>Himertula</i> sp.	Phaneropterinae	Tettigoniidae	Grass, soil, groundnut
32	<i>Trigonocorypha unicolor</i> (Stoll)	Phaneropterinae	Tettigoniidae	Cotton
33	Sp. 1	-	Tetrigidae	Okra

- unknown

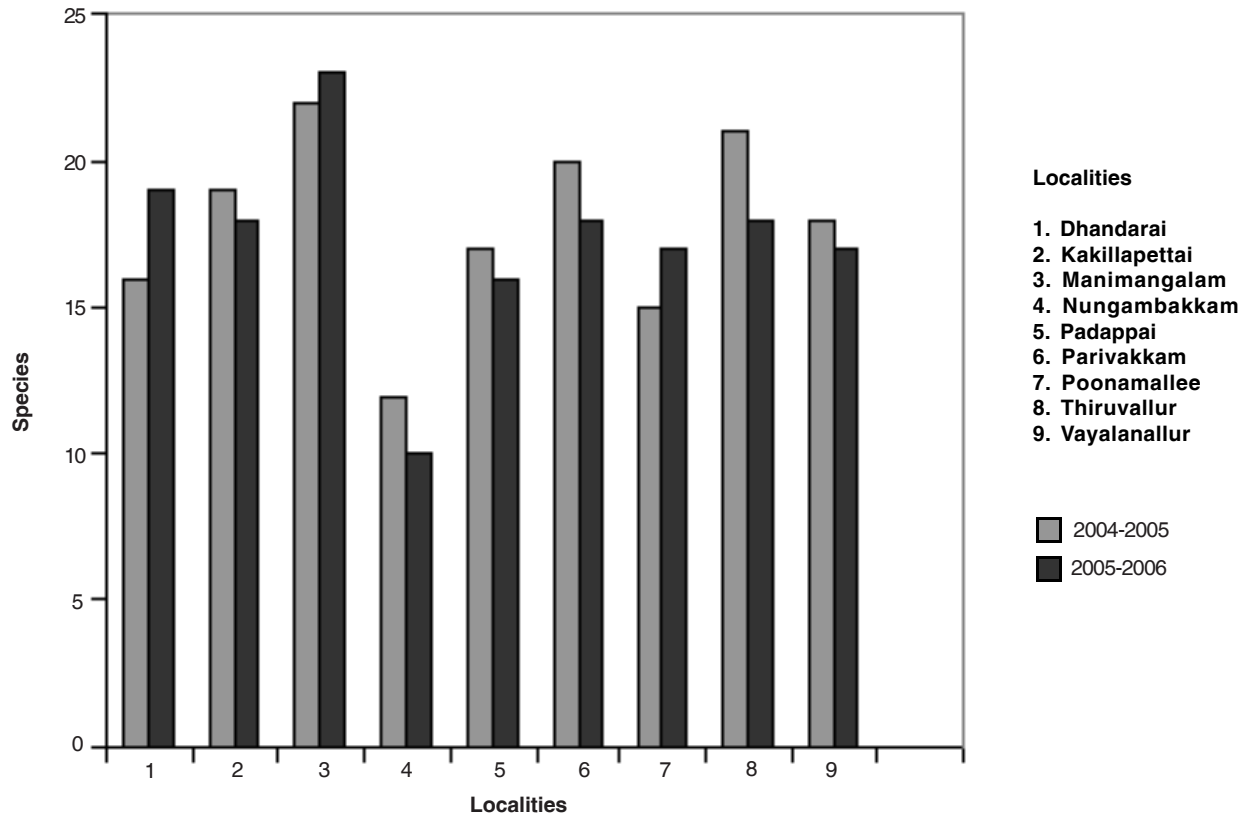
**Figure 1. Total number of grasshopper species recorded from different localities in northeastern Tamil Nadu during 2004 to 2006**

Table 2. Percentage of grasshopper species collected from different habitats

Associated habitat	Number of species recorded	Percentage of species
Brinjal	3	9.1
Calotropis	1	3.0
Cotton	2	6.1
Curry leaf	1	3.0
Grass	18	54.5
Groundnut	7	21.2
Maize	1	3.0
Okra	3	9.1
Rice	5	15.2
Soil	11	33.3
Tapioca	1	3.0

Kakillapettai, Manimangalam, Nungambakkam, Padappai and Parivakkam. Once *P. pictus* was an oligophagous grasshopper feeding on milkweed plant alone and was forced to extend its host range to different taxa due to non-availability of its natural hosts, evolving into a more flexible oligophagous insect. Pruthi (1954), Batra (1955) and Bindra (1958) have recorded host shifting of *P. pictus* from *Calotropis procera* (in northern India) and *C. gigantea* (in southern India) to many horticultural plants. According to Bindra (1958) the selection of food plant by *P. pictus* depends on the plant species available, the grasshopper's intrinsic likes and dislikes and whether it has previously been starved. Tettigoniids, the long-horned grasshoppers are significantly important orthopterans since they sometimes encounter other insects. According to Shepard et al. (1987), the Tettigoniid *Conocephalus* sp. is a predator of rice bug and stem borer eggs as well as planthopper and leafhopper nymphs. They also reported that each predator can consume 3 to 4 yellow stem borer egg masses a day.

A thorough understanding of the relationship between habitat type and distribution of herbivorous insects like grasshopper is necessary to achieve crop health through ecologically based pest management. The present findings indicate that grasses inside and around the fields supported a large number of grasshopper species. Hence, the cultivation technique can be modified in such a way that the preferable host plants like grasses may be grown around the field. This will reduce crop damage. Long-term studies on grasshopper distribution among different host plants in agroecosystems are necessary to monitor the impact of modern agriculture on host plant shifting and the relative abundance of grasshoppers on various crops.

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