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Survey of prey and predator hemipteran (Insecta: Hemiptera) insects in different agro-ecosystems in north-eastern Tamil Nadu

V Anbalagan[1*], M Gabriel Paulraj[2], S Ignacimuthu[3], K Indrakumar[4]
[1] Department of Zoology, Vivekanandha College of Arts and Sciences for Women (Autonomous), Tiruchengode, Namakkal, Periyar University, Tamil Nadu, India
[2] Department of Entomology, Entomology Research Institute, Loyola College, University of Madras, Chennai, Tamil Nadu, India
[3] Department of Entomology, Xavier Research Foundation, St. Xavier`s College, Palayamkottai, Manonmaniam Sundaranar University, Tirunelveli, Tamil Nadu, India
[4] Department of Entomology, Mugha Eri Silkworn Seed Production, Central Silk Board, Tura, Meghalaya, India

Abstract
Survey of Hemipteran insects in fifteen sites of northeastern Tamilnaddu was carried out from January 2021 to December 2022. 62 Hemipteran species grouped under twenty-one families, Insect group of 20 predator and 42 pest populations were recorded. Family Reduvidae was found to be the predominant group of insects represented by 14 species by the maximum 13 predator and one pest. It amounted for 22.58% of the total species collected. The family Pentatomidae was the second largest group represented by 9 species. This family had 14.51% insects recorded in this study.

Keywords: Reduvidae, cicadellidae, brinjal, *Tapioca*, *Calotropis*

Introduction
Agriculture is more than an economic activity designed to produce crops for sustenance of life. Farming is now viewed as a much larger system with many interacting parts, including environmental, economic and social components (Gliesman, 2001; Flora, 2001) some of the major food crops are brinjal, bhendi and cowpea which are extensively grown in India. The Hemiptera are the dominant group of exopterygota insects. They range in length from less than 1 to 110 mm, and comprise insects with a great range of different structural and behavioral features, occupying a wide variety of environment. Most Hemiptera are terrestrial and phytophagous. The group of Hemiptera: Auchenorrhyncha, it is the largest in number having more than 15.000 described species. Most species are phloem feeders and important vectors of virus diseases. At species level, examination of the male genitalia is essential. Sri SuharniSiwi, (2005) reported Suborder Heteroptera (true bugs) includes groups which are carnivorous; they often produce a repellent odour-used for defense from a specialized gland. Many are also aquatic, such as water boatman (family Corixidae), Hemiptera has a total of 6250 species and subspecies in 913 genera and 25 subfamilies all over the world (Maldonado, 1990) [11]. Among these 31 genera 342 species with belong to the subfamily Peiratinae. Distant (1902b) in his fauna of British India described 31 species under 6 genera in the subsamilies Maldonado (1990) [11], Ambrose (2006), Biswas *et al*, (1994, 2010) [5, 6] reported 465 species belonging to 144 genera under 14 subfamilies of the family Reduviidae from India. The Cydnidae family includes 73 genera and 526 species all over the world (Jerzy A. Lis, 1999), whereas in India, we have a record of 28 genera and 72 species. The present study was undertaken to record the hemipteran insects from different agro-ecosystems and habitats in chosen localities in Kancheepuram and Thiruvallur districts of Tamil Nadu, India.

Materials and Methods
A survey was carried out in fifteen locations in North-eastern Tamil Nadu from January 2021 to December 2022. Most of the studies were confined to Mangadu, Kakilipettai, Paraniputhur, Setthupattu, Padappai, Manimangalam, Parivakkam, Vayalanallur, Pallavakkam, Tamaraipakkam, Neymam, Seethancheri, Pechipallyam, Vengathoor and Thandurai villages. In each habitat within a location, random sites were sampled weekly with the help of a sweeping net (25 cm diameter); we also collected the insects by hand picking in the same sites. The Hemiptera insects found in different host plants such as from Brinjal, Bhendi, Cotton, *Tapioca*, Maize, Paddy, cow pea, pigeon pea, soybean, green leaves, castor, Groundnut, grassland, *Calotropis*, Bumkin, Bittergourd, and Bottle gourd were collected.

Study Area
Area latitude and altitude
Northeastern Tamil Nadu is situated in between the Bay of Bengal and Chennai city It lies between 11˚00`to12˚ 00`North L attitudes and 77˚28`to78˚50″East longitude in Kancheepuram district. Tiruvallur district is located between 12˚15and 13˚.5`N Latitude and 79˚15` and 80˚20″E Longitude. The climate is normal during winter but very hot in summer. The maximum and minimum temperatures are 37, 6`C and 21.4`C respectively. The district depends on the south-west and north-east Monsoons for rainfall. The total cultivated area is 14, 8962.846/Hec.

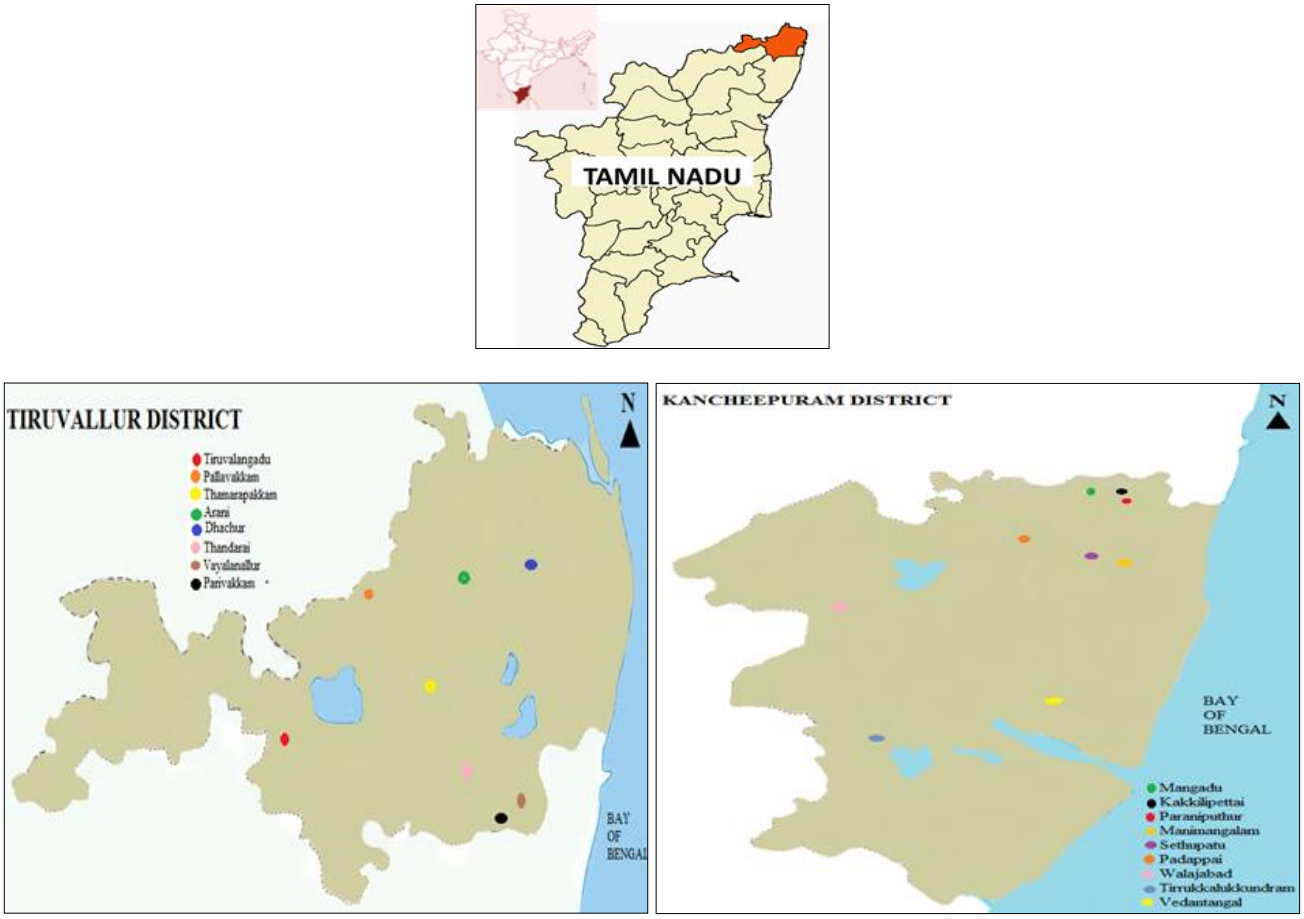

Fig 1: Map showing different sites of insect collection in Tiruvallur and Kancheepuram districts

Identification of Specimens

Field collected Hemiptera insects and immature stages of these adults were taken to the Entomology Research Institute, Loyola College, Chennai, India. They were identified to species level using identification keys provided by Fraser (1933, 1934 and 1936). To confirm identification some of the collected species were sent to the Zoological survey of India, Chennai for verification.

Results and discussion

Hemiptera insects 62 species of were recorded from twenty-one families such as Pentatomidae, Lygaeidae, Acanthosomatidae, Belostomatidae, Pyrrhocoridae, Blissidae, Aradidae, Geocoridae, Pachygronthidae, Coreidae, Corixidae, Cydnidae, Miridae, Membracidae, Rhopalididae, Pachygronthidae, Nabidae, Aphididae, Piesmatidae, Cicadillidae, Cicadidae and Reduvidae. In Reduvidae family was the most dominant with 22.58% species collected (14 species) the group of maximum13 predators and one pest insect throughout the study period. The second largest family was Pentatomidae with 14.51% species collected (9 species) were highly abundant in legume cow pea *Vigna unguiculata* L. crop field. Wisdom *et al*, (2011) [17] reported that in legumes, cowpeas have mixed modes of pollination. Some say that cowpeas are self-pollinated while others say that it is cross-pollinated; it undergoes both self and cross-pollination. Ambrose and Claver, (1995) [1], Schaefer, (1988) [14] reported that Reduvidae insects are common in pigeonpea fields; they feed on a number of insect pests. Reduvidae predator's abundance was higher than that other hemipteran pretators in pigronpea agro-ecosystems (Bhatnagar, 1983, Minja *et al* 1999) [4, 13]. The Aphididae family ranked third with 9.67% of total species collected (6 species). There were 213 leafhopper species recorded in Sri Lanka of which 103 species were reported from Peradeniya (Melichar, 1903; Distant, 1908; Dworakowska, 1994; Viraktamath and Parvathi, 2002 and Viraktamath, 2007) [12, 8, 16, 15]. *Amrasca biguttula biguttula* (Ishida) formally *Empoasca devastant* Distant, a well-known vector of little leaf of brinjal in India Nielson, (1979) was found in the vegetable ecosystem only. It contributed 10 % of the total leafhopper abundance in vegetable ecosystem. Okra, brinjal, bitter gourd and beans are the breeding host of this species. Another green leafhopper, *Empoasca triangularis* (Dworakowska, 1980a) was collected from beans, carrot, and brinjal. *Empoascanara maculifrons* and *Empoascanara cilla* were found in both ecosystems mainly on adjoining grasses. Gnaneswaran, *et al*, (2006) [10] reported that Leafhoppers are an important prey for predators, particularly for spiders, ants, and birds. They are also essential host organisms for parasitoids of the families Dryinidae, Mymaridae, Pipunculidae and Strepsiptera. Totally 45 species of leafhoppers were collected in paddy and vegetable ecosystems.

Cicadelidae was represented by 8.06% (5species) followed Blissidae with 6.45% (4species), Lygaeidae, Pyrehocoridae, Pachysronthidae, Miridae, all with 4.83% (3species), Membracidae, Coreidae with 3.22% (2species), The common groups Belestonatidae, Acanthosomatidae, Corixidae, Cydnidae, Rhopalidae, Nabidae, Piesmatidae and Cicadidae had (1.61%) one species in all sites.

It is also established that insect pollinators are essential for many crops. species of Cicadilidae family were highly

found in brinjal field and bhendi field. Maximum numbers of Hemipteran pests were also recorded in brinjal and bhendi field. Minja *et al* (1999) [13] reported substantial predation of insect pests of pigeon pea by the assassin bugs within pigeon pea fields; the relative mix of predacious reduviids varied with locality and season.

Table 1: Hemiptera insects associated with different crops

S. No	Order	Family	Species Name	Habitat	Pest/Predator
1	Hemiptera	Pentatomidae	*Andrallus spinidens* (Fab, 1787)	Paddy	Predator
2		”	*Podisus* sp	Cowpea, pigeon pea	Predator
3		”	*Banasa dimiata* (Say, 1831)	Brinjal	Pest
4		”	*Dolycoris indicus* (Stall)	Pigeon pea	Pest
5		”	*Eysarcoris fabricii* (Kirkaldy, 1904)	Brinjal	Pest
6		”	*Eysarcoris guttiger* (Thunb)	Soybean	Pest
7		”	*Halyomorpha halys*	Brinjal	Pest
8		”	*Nezara viridula* (Linn)	Cowpea	Pest
9		”	*Troilus luridus* (Fab, 1787)	Green leaves	Predator
10		Lygaeidae	*Lygaeus kalmia*	Bhendi, pigeon pea	Pest
11		”	*Paromius gracilis* (Rambur,1839)	Paddy	Pest
12		”	*Oncopeltus fasciatus*	Bhendi	Pest
13		”	*Neacoryphus bicrucis*	Bhendi, brinjal	Pest
14		Acanthosomatidae	*Elasmucha* (Linn)	Groundnut, cotton	Pest
15		Belostomatidae	*Diplonychus rusticus* (Fab)	Paddy	Predator
16		Pyrrhocoridae	*Pyrrhocoris apterus* (Linn, 1758)	Cowpea	Pest
17		”	*Dysdercus cingulatus*	Brinjal, maize	Pest
18		Aradidae	*Aradus* sp	Groundnut	Pest
19		Membracidae	*Tricentrus* sp	Maize, gastor leaf	Pest
20		”	*Leptocentrus*	Greenleaves	Pest
21		Blissidae	*Blissus leucopterus*	Bhendi	Pest
22		Geocoridae	*Geocoris tricolor* (Fab)	Brinjal	Predator
23		”	*Geocoris* sp	Brinjal	Predator
24		Pachygronthidae	*Oedancala crassimana* (Fab,1803)	*Gajanus gajan*, groundnut	Pest
25		Coreidae	*Leptoglossus* (genus)	Cowpea	Pest
26		”	*Leptoglossus oppositus*	Brinjal, cotton	Pest
27		”	*Acanthoceohala terminalis*	Groundnut, *gajanus gajan*	Pest
28		”	*Anoplocnemis phasiana*	Agathi	Pest
29		Corixidae	*Micronecta* sp	Grassland, paddy	Pest
30		”	*Micronecta janssoni* (Thirumalai, 1989)	Paddy, groundnut	Pest
31		Cydnidae	*Pangaeus* genus	Brinjal	Pest
32		Miridae	*Cyrtorhinus lividipennis* (Reuter)	Paddy	Predator
33		”	*Lygus lineolaris* (Palisot de Beauvois,1818)	Green leaves	Pest
34		”	*Lopidea* genus	Green leaves, pigion pea	Pest
35		Rhopalidae	*Boisea trivittata*	*Gajanus gajan*, cowepea	Pest
36		Nabidae	*Lasiomerus annulatus* (Reuter, 1872)	Brinjal, pigion pea	Pest
37		Aphididae	*Aphis* genus (Linn, 1758)	Bhendi	Pest
38		”	*Amrasca biguttula biguttula* (Ishida)	Brinjal, groundnut, bhendi	Pest
39		”	*Amrasca devastans*	Brinjal	Pest
40		”	*Aphis craccivora* (Koch)	Brinjal	Pest
41		”	*Rhopalosiphum nymphaeae* (Linn)	Paddy	Pest
42		Piesmatidae	*Piesma* (Genus)	Bhendi, Brinjal	Pest
43	Suborder: Homoptera	Cicadillidae	*Cofana spectra* (Distant)	Paddy, grassland	Pest
44		”	*Cofana unimaculata*	Paddy, cotton	Pest
45		”	*Orosius albicinctus*	*Calotropis*	Pest
46		”	*Hishimonus phycitis* (Distant, 1908)	Cowpea, green leaves	Pest
47		”	*Empoasca devastans* (Distant)	Green leaves	Pest
48		Cicadidae	*Cestiusphycitis* (Distant, 1908)	Cow pea, pigeon pea	Pest
49		Reduvidae	*Ariluscollaris* (Burmeister, 1835)	Gastor leaf	Predator
50		”	*Ariluscristatus* (Linnaeus)	Cowpea, grassland	Predator
51		”	*Endochus cingalensis* (Stal, 1861)	Green leaves	Predator
52		”	*Evuagoras plagiatus* (Burmeister, 1834)	Bumkin, Brinjal,	Pest
53		”	*Linshcosteus karupus* (Distant, 1904)	Redgram, cotton	Predator
54		”	*Nabis gigas* (Latreiue, 1804)	Cowepea, pigeon pea	Predator
55		”	*Oncocephalus aterrimus* (Distant, 1909c)	Green leaves	Predator
56		”	*Phymata* genus	Cotton	Predator
57		”	*Polididus armatissimus* (Stal)	*Calotropis*	Predator
58		”	*Pscllіopus cinctus* (Fab, 1776)	Bitter gourd, Bumkin	Predator
59		”	*Rhynocoris fuscipes* (Fab)	Cowpea, pigeon pea, cotton	Predator
60		”	*Staccia diluta* (Stal, 1859)	Paddy, cowepea	Predator
61		”	*Zelus collaris* (Fab, 1803)	Bottle gourd, Bumkin	Predator

62		”	*Zelus longipes*	Bhendi	Predator

Table 2: Percentage of Hemiptera insects collected from different habitats

Name of the habitats	Number of the species recorded	Percentage of species (%)
Paddy	22	10.78
Cowpea	24	11.76
Pigeonpea	32	15.68
Brinjal	18	8.82
Bhendi	12	5.88
Soybean	20	9.80
Greenleaves	6	2.94
Cotton	12	5.88
Grountnut	10	4.90
Maize	7	3.43
Grassland	11	5.39
Calotropis	6	2.94
Bumkin	8	3.92
Bittergourd	11	5.39
Bottlegourd	9	4.41
Castor leaf	2	0.98
Tapioca	6	2.94

Table 3: Numbers of pest and predator different families

Family Name	Pest	Predator	No. of insects
Pentatomidae	6	3	9
Lygaeidae	4	-	4
Acanthosomatidae	1	-	1
Belostomatidae	-	1	1
Pyrrhoccridae	2	-	2
Aradidae	2	-	2
Membracidae	2	-	2
Blessidae	1	-	1
Geocoridae	-	2	2
Pachygronthidae	1	-	1
Coreidae	4	-	4
Corixidae	2	-	2
Miridae	2	1	3
Rhopalidae	1	-	1
Nabidae	1	-	1
Aphididae	5	-	5
Piesmatidae	1	-	1
Cicadillidae	5	-	5
Cicadidae	1	-	1
Reduvidae	1	13	14
Total	42	20	62

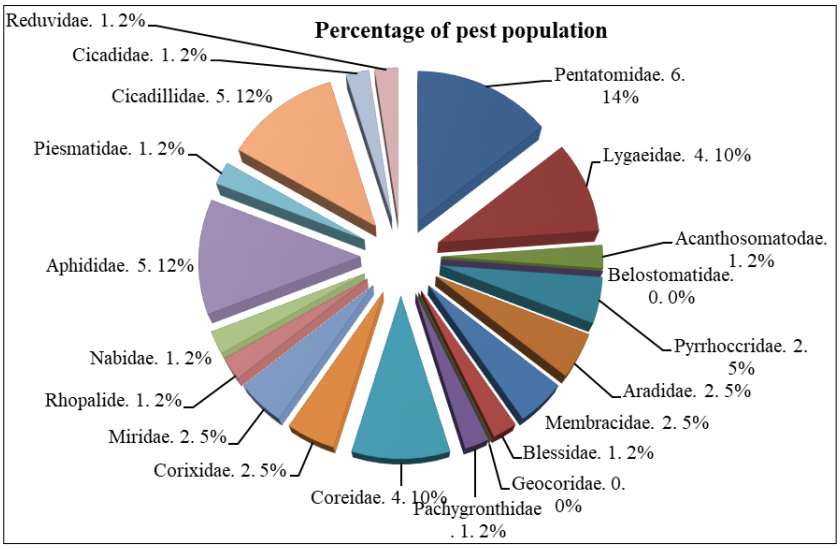

Fig 2: Number of pest population in different families

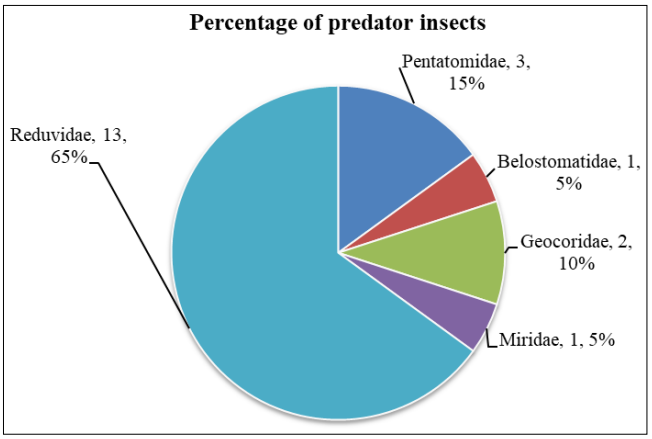

Fig 3: Number of predator insects in different families

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Competing Interests
Authors have declared that no competing interests exist.

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