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Studies on Seasonal activity of insect pests associated with high altitude agriculture, horticulture and forestry ecosystems of Kashmir Himalaya by utilizing fluorescent light trap

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This work incorporates detailed field observations on seasonal activity of insects damaging valuable agricultural crops, horticultural and forestry plantation and other economically important plants, occurring at high altitude regions of Kashmir Himalaya by utilizing light-trap (12 volt fluorescent light source) operated through solar power battery, conducted during different seasons of 2002-2003. The light- trapping experiment has yielded 2383 insect pest individuals, belonging to five orders (Coleoptera, Hemiptera, Homoptera, Lepidoptera and Orthoptera), incorporating 54 species, belonging to 37 genera under 16 families. The population abundance and seasonal flight activity of various species captured has been studied. The predominant insect species recorded was *Adoretus* sp. (scarabaeid) followed by *Mythimina* sp. (noctuid). The abundant species belonging to different families and orders, in order of decreasing dominance were *Euproctis* spp. (lymantrid), *Brahmina* spp. (scarabaeid), *Lacon* spp.(elaterid), *Epilachna* sp. (coccinellid), *Anomala* spp.(scarabaeid), *Pycna repanda* (cicadid), *Agrotis* spp. (noctuid). The seasonal flight activity of the least abundant species trapped with 1 to 50 representative individuals has also been studied.

Keywords:- Seasonal activity, light trapping, Kashmir Himalaya

INTRODUCTION

The Valley of Kashmir is about 187 Kms long and 3.5 to 30 Kms wide, located at a height of over c 2770 meters above sea level, being surrounded on almost all sides by mountain ranges, varying in height, the highest being c 5550 meters above sea level. The Kashmir Valley has a total geographical area of 15948 square Kms and it falls between $32^0.22^/$ to $34^0.43^/$ North latitude and $73^0.52^/$ to $75^0.42^/$ East longitude. The temperature of Kashmir varies from -14^0C in winter to 35^0C in summer. Weather shows marked seasonality, summers are much less rainy than spring and quite warm (Raina, 1977; Hussain, 1987). In Kashmir, both the maximum and minimum temperature starts falling by August and quite low by October. By the end of December, the Valley usually experiences snow, which gradually disappear by the end of February and rains replace snow in spring. The Jammu & Kashmir State is situated in the sub- tropical latitudes, but due to its location, owing to physical barriers *i.e.*, the high-mountain ranges, the Valley gets cut–off geographically from the Jammu & Ladakh region and unlike these two regions, maintains a temperate climate.

In Kashmir valley, all agricultural crops, including economically important plants, *viz.*, cereals, pulses, fruits, vegetables, fodder, forages, oil seed, ornamental, medicinal and forest range plantations, are known to be damaged by a number of insect species. These insect pests can be broadly classified in to three groups, *viz.* borers, foliage destructing insects and defoliators. They inflict damages to plants in a number of ways, including malformation of various plant parts, gall formation, destruction of foliage, stunted growth, leaf curling, and obstruction in assimilation, wilting and sometimes collapse of a plant. Due to these damages, there is the reduction in crop yield or death of economic plantations. In addition to these damages, some insects during their attack prefer saplings and young plants, some attack older ones, others infest unhealthy and dying trees, and still others prefer dead material, while some attack even rotten wood.

It was, therefore, suggested that under present work, a preliminary survey, seasonal activity of insect pests of some crops and economically important plants in Kashmir Himalaya be carried out. Earlier, in Kashmir Himalayan

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region, so far no detailed work on seasonal flight activityof insects through insect light-trapping has been done. However, in this direction some work have been carried out on insect damaging crops and economically important plants in Kashmir Himalayan region Raina and Baghat (2005), (Baghat and Raina,2006); In this connection , few recently published important papers in western.

Himalayan region are provided by Deshraj (1993), Devi *et al*.(1994), Chandel *et al*. (1994) and Kumar & Kumar (2000) In abroad significant research studies have been conducted on light-trapping and these traps were found useful in survey work, both for particular species and groups (Bogush,1958 and Otake & Kono, 1970), however some studies were carried out by Allosopp & Logan, 1999 on the seasonal flight activity of Scarab beetles in Queens land.

Materials and Methods

The present research work on light-trapping was initiated at Pahalgam (Lidder Valley) during 2002-2003 from the month of June, 2002 and continued till November, 2002. From December, 2002 to February, 2003 no trap was operated because of low temperature and adverse climatic conditions, coupled with no insect life activity in the selected habitat. Further, the light-trapping was restarted from March to November, 2003, covered three seasons (spring, summer and autumn).

The insect light-trap fitted with of 12 volt fluorescent light source operated through solar power battery was used at the field site for trapping the insects. The insect light- trap was placed slightly above the ground and adjacent to field/cropping areas, and to the forest zones at Kullar (Pahalgam). The lamp on the insect light- trap was switched on at 7:00 pm and switched off at 5:30 am throughout the trapping period. During the operation of light-trap, the trapped insects, were either retained alive or killed by placing block of plaster of Paris, saturated with killing agents, placed on the bottom of the trap. The chlorinated hydrocarbons, *viz*. tetrachloroethylene, trichloroethylene and tetrachloroethane were used as killing agents. The samples were taken daily from the trap at 07:00 hours with the help of camel hair brush and entomological forceps, thereafter placed in polythene bags/ envelops and brought to laboratory for analysis and identification. Cumulative monthly data was compiled from the daily observations of different insect orders, families, genera and species captured. The meteorological data for the period of study was taken from the meteorological observatories of the Department of Meteorology Srinagar. The identified insect material has been deposited in the Entomology Section, P. G. Department of Zoology The University of Kashmir, Srinagar.

Results and Discussion

Detailed investigations on insects damaging agricultural crops cereals, pulses, vegetables, fruits, oil seeds, fodder/ forage besides, other economically important plants, *viz*. forest range plantations, medicinal/aromatic and ornamental plants, existing at high-altitude regions of Kashmir Himalaya, utilizing 12 volt fluorescent light-trap, have been carried out for the first time in this region of temperate agro-ecosystem.

The thorough field research work on light-trapping was accomplished with the objective to identify the insect species of this area and to assess incidence, seasonal flight activity and abundance of different species encountered, damaging various crops and economically important plants of Kashmir Himalayan region.

The extensive insect light-trapping has resulted more than 3074 insect/pest individuals (general and economically important), yielded to 66 species, distributed over 57 genera, belonging to 24 families, under 9 different insect orders (Table 1.).

The systematic screening for total catch of insects and pests of valuable crops and economically important plants of this region has revealed about 2383 individuals, representing 5 orders, *viz*. Coleoptera, Hemiptera, Homoptera, Lepidoptera and Orthoptera, covering 16 families and incorporating 37 genera, distributed over 54 insect pest species (Table 1.).

The Coleoptera was found to be a dominant order, in respect to individuals, families, genera and species trapped, the order showed 52.79% of the dominance as compared to other orders followed by Lepidoptera about 39.27% and Hemiptera 4.02% and next lowest percentage of individuals was found in case of Homoptera, 3.77% and Orthoptera 0.12% (Table 1.).

The various economically important families, belonging to 5 orders encountered during the light-trapping are: - Acrididae, arctiidae, buprestidae, cerambycidae, cicadidae, coccinellidae, elateridae, geometridae, lygaeidae, lymantriidae, meloidae, miridae, noctuidae, pentatomidae, saturniidae scarabaeidae. Among these families, scarabaeidae was found to be the most dominant comprising a total catch of 1038 pest individuals, under 16 insect species. The dominant families recorded, with the total catch (figures in parenthesis) in the order of decreasing dominance are : Scarabaeidae (43.55%), Noctuidae (23.03%), Lymantriidae (12.84%) , Elateridae (4.65%), Coccinellidae (3.985), Cicadidae (3.77%),

Table 1 : Total number of individuals general and economically important (identified/ unidentified) insect individuals pertaining to different insect orders, captured in fluorescent light-trap at Kullar (Pahalgam) from June to November 2002 and March to November, 2003.

Insect Order	Total Number of families trapped	Number of economically important families	Number of economically important Genera	Number of economically important species	% catch (identified)	Total number of individuals captured	Total identified economically important individual pests	Total number of General and unidentified insect individual
Coleoptera	09	06	15	24	52.79	1509	1258	251
Diptera	02	-	-	-	-	176	-	176
Hemiptera	03	03	04	05	4.02	96	96	-
Homoptera	01	01	02	02	3.77	90	90	-
Hymenoptera	01	-	-		-	70	-	70
Lepidoptera	05	05	15	22	39.27	966	936	30
Neuroptera	01	-	-	-	-	25	-	25
Trichoptera	01	-	-	-	-	139	-	139
Orthoptera	01	01	01	01	0.12	3	03	-
Total	24	16	37	54		3074	2383	691

Arctiidae (3.23%), Pentatomidae (2.01%), Miridae (1.30%), Lygaeidae (0.71%), Meloidae (0.37%), Cerambycidae (0.16%), Acrididae (0.12%), Geometridae (0.08)%, Saturniidae (0.08%) and Buprestidae (0.04%).

The maximum number of families trapped, pertaining to the order Coleoptera as 6, followed by 5 families, belonging to Lepidoptera. The rest of the insect orders incorporated a total number of families as 3 ,1 and 1 in Hemiptera Homoptera and Orthoptera respectively (Table 2).

Various economically important insect pest species, belonging to different orders and families, trapped in

Table 2 :- Total number of individuals and species of insect pests of crops and economically important plants, belonging to different orders and families taken by fluorescent light trap at (Pahalgam) during the Year 2002 (June-November) and the year 2003 (March - November).

Order/Family	Total Catch			Number of Species Captured during 2002	Number of Species Captured during 2003	Total Species Captured 2002 & 2003
	2002 (I)	2003 (II)	(I) + (II)			
Coleoptera						
Buprestidae	01	-	01	01	--	01
Cerambycidae	01	03	04	01	02	02
Coccinellidae	60	35	95	01	01	01
Elateridae	75	36	111	02	02	02
Meloidae	06	03	09	02	01	02
Scarabaeidae	441	597	1038	12	16	16
Hemiptera						
Lygaeidae	17	-	17	02	--	02
Pentatomidae	15	33	48	02	02	02
Miridae	25	06	31	01	01	01
Homoptera						
Cicadidae	07	83	90	02	02	02
Orthoptera						
Acrididae	-	03	03	--	01	01
Lepidoptera						
Arctiidae	30	47	77	05	06	06
Lymantriidae	74	232	306	03	02	03
Geometridae	01	01	02	01	01	02
Noctuidae	440	109	549	05	07	09
Saturniidae	-	02	02	--	02	02
Grand Total	1193	1190	2383	40	46	54

fluorescent light-trap during June to November, 2002 and March to November 2003 is presented in (Table 3).

Seasonal occurrence of various families under five orders of economic importance trapped in fluorescent light trap is given as under :

Order	Summer season		Spring season	Autumn season	
Family	2002	2003	2003	2002	2003
Coleoptera					
Buprestidae	(+)	(-)	(-)	(-)	(-)
Cerambycidae	(+)	(-)	(-)	(-)	(-)
Coccinellidae	(+)	(+)	(-)	(+)	(+)
Elateridae	(+)	(+)	(-)	(+)	(+)
Meloidae	(+)	(-)	(-)	(-)	(-)
scarabaeidae	(+)	(+)	(+)	(+)	(-)
Hemiptera					
Lygaeidae	(+)	(-)	(-)	(-)	(-)
Pentatomidae	(+)	(+)	(-)	(-)	(+)
Miridae	(+)	(-)	(-)	(+)	(-)
Homoptera					
Cicadidae	(+)	(+)	(-)	(+)	(+)
Lepidoptera					
Arctiidae	(+)	(+)	(-)	(+)	(+)
Lymantriidae	(+)	(+)	(-)	(+)	(+)
Geometridae	(+)	(-)	(-)	(-)	(+)
Noctuidae	(+)	(+)	(-)	(+)	(+)
Saturniidae	(-)	(+)	(-)	(-)	(+)
Orthoptera					
Acrididae	(-)	(+)	(-)	(-)	(-)

+ = Presence, - = Absence

Their exists a definite relationship between light-trap catch and the meteorological phenomenon like temperature and rainfall. During 2002 the highest catch was detected during the month of August with total catch of 22.07% when the Max. temp. ranges to 26.1 and Min. temp ranges to 14.3^{0}C with average rainfall 11 mm, while in 2003 the highest flight activity was observed during the month of July with total catch of 20.68% owing to average max. Temp 26.2^{0}C and average minimum temperature 13.4^{0}C with average rainfall 11 mm. with increase in the average maximum temperature and average minimum temperature in the study site, the rise in temperature has been found responsible for highest flight activity of insects showing average max temperature 26.1^{0}C to 26.2^{0}C and average minimum temperature 13.4^{0}C to 14.3^{0}C with average rainfall 8 to 11 mm.

The detail seasonal catch of different insect species trapped during different seasons in the year 2002-2003 are highlighted below:-

Total summer catch 2002 (43.97%), autumn catch 2002 (6.08%), spring catch 2003 (0.67%), Summer catch 2003 (42.76%) and total autumn catch during 2003 (6.50%).

From above, it is evident that of the above trapping experimental period, summer season showed the dominant catch during both the trapping years with July being peak. The order-wise break up of insect pest species pertaining to various species and families, trapped in various months/ seasons in light traps during the period June to November 2002 and March to November, 2003 is presented in the (Table 3). This table shows Coleopterans being abundant in July month of summer season Whereas Lepidopterans were trapped in abundance during August in fluorescent light, showing their early activity from the month of June and continued till October. Members under the order Hemiptera and Homoptera existed in dominance during the month of August and September respectively. However, in these two orders flight activity was not observed in spring season.

Seasonal flight activity of insect pests trapped :
The difference between monthly/seasonal catch of insects pest individuals covering different species, collected from fluorescent light- trap is given as under:-

Month/year	Individuals trapped %age in (paren-thesis)	Max temp. (0°C)	Min. Temp. (0°C)	Avg. Rain fall (mm)
June,2002	0.75	25. 0	8. 7	14
July,2002	21.14	26. 9	12. 2	08
August,2002	22.07	26. 1	14. 3	11
September,2002	4.02	21. 6	7. 1	15
October,2002	2.05	20. 7	2. 6	04
November,2002	0.00	15. 4	-1. 5	01
December,2002	0.00	8. 1	2. 9	0. 4
Januarary,2003	0.00	8. 2	4. 3	0. 4
Feburary,2003	0.00	7. 1	2. 8	08
March,2003	0.00	10. 0	-0. 9	14
April,2003	0.00	17. 5	3. 3	12
May,2003	0.67	19. 3	3. 3	4.5
June,2003	4.61	25.6	7.7	10
July,2003	20.68	26.2	13.4	11
August,2003	17.45	25. 4	12. 1	4.6
September,2003	6.12	22. 9	9.3	5.0
October,2003	0.37	19.5	1.8	1.0
November,2003	0.00	19. 5	-1. 0	1. 2

The abundant species, belonging to different families and orders are listed in order of decreasing abundance were: *Mythimina sp.* 405 individuals (Noctuid), *Adoretus sp.*(Scarabaeid), *Porthesia xanthorrhoea* (Lymantriid),

Table 3 :- List of insect pest species of crops and economically important plants, captured through Fluorescent light-trap with number of individuals during June to November 2002 and March to November, 2003.

Insect Species	Order/ Family	Total No. of Individuals 2002 (I)	Total No. of Individuals 2003 (II)	Grand Total I & II	% actch
Acrida sp.	O., Acd	-	03	03	0.12
Adoretus sp.	C., Sca.	234	296	530	22.24
Adoretus cribratus (White)	C., Sca.	86	075	161	6.75
Aeolesthes sarta (Solsky)	C., Cer.	-	02	02	0.08
Agrotis biconica (Schiff.)	L., Noc.	10	12	22	0.92
Agrotis ipsilon (Fabr.)	L., Noc.	19	18	37	1.55
Agrotis sp. - I	L., Noc.	-	13	13	0.54
Agrotis sp. - II	L., Noc.	-	07	07	0.29
Agrotis sp. - III	L., Noc.	-	06	06	0.25
Amsacta lactinea (Crammer)	L., Arc.	01	01	02	0.08
Anomala rufiventris (Hope)	C., Sca.	58	24	82	3.44
Anomala stoliezkoe (Hope)	C., Sca.	07	02	09	0.37
Antheraea paphia (Linn.)	L., Sat.	-	01	01	0.04
Antheraea sp.	L., Sat.	-	01	01	0.04
Aserica (Autoserica) -sp.I	C., Sca.	-	06	06	0.25
Aserica (Autoserica) sp.II	C., Sca.	25	20	45	1.88
Boarmia sp.	L., Geo.	01	-	01	0.04
Brahmina sp.	C., Sca.	06	12	18	0.75
Brahmina coriacea (Hope)	C., Sca.	01	79	80	3.35
Brahmina conrata (Blunch)	C., Sca.	05	19	24	1.00
Callimorpha principalis (Koll.)	L., Arc	04	10	14	0.58
Calocoris stollozkanus	He., Lyg.	03	-	03	0.12
Cladarctia quadriramosa (Koll.)	L., Arc	02	07	09	0.37
*Caponodis. miliaris (*Klug.)	C., Bup.	01	-	01	0.04
Cuclia albipennis (Hampson)	L., Noc.	03	-	03	0.12
Cyaneolytta sp.I	C., Mel	05	03	08	0.33
Cyaneolytta sp.II	C., Mel.	01	-	01	0.04
Dasychira grotei (Moore)	L., Lym.	08	-	08	0.33
Epilachna sp.	C.,Cocc.	60	35	95	3.98
Eummelea sp.	L., Geo	-	01	01	0.04
Euschistus conspersus	He., Pen	10	26	36	1.51
Euschistus sp.	He., Pen	05	07	12	0.50
Euproctis vitellina (Koll.)	L., Lym..	03	90	93	3.90
Euproctis (= Porthesia) xanthorrhoea (Koll.)	L., Lym.	63	142	205	8.60
Hadena perdentata (Schiff.)	L., Noc	-	18	18	0.75
Heteronychus robustus (Redt.)	C., Sca.	-	01	01	0.04
Hilyotrogus holosericeus(Hope)	C., Sca.	08	25	33	1038
Lacon modestus	C., Ele	40	15	55	2.30
Lacon sp.	C., Ele	35	21	56	2.34
Lemyra sp.	L., Arc.	14	13	27	1.13
Lophosternus hugeli.(Redt.)	C.,Cer.	01	01	02	0.08
Lygus sp.	He.,Mir.	25	06	31	1.30
Melolontha furcicanda (Anst.)	C.,Sca	08	10	18	0.75
Melolontha melolontha (Hope)	C.,Sca	-	20	20	0.83
Mythimina sp.	L.,Noc	405	35	440	18.16
Ophiusa arcuata (Moore)	L., Noc.	03	-	03	0.12

Table 3 Contd. .....

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Oryctes nasicornis(Hope)	C.,Sca	02	02	04	0.16
Oryctes rhinoceros(Linn.)	C.,Sca	-	04	04	0.16
Pharyllus pistacinus	He., Lyg.	14	-	14	0.58
Pycna repanda	Ho.,Cica	06	82	88	3.69
Sena sp	Ho.,Cica	01	01	02	0.08
Serica sp	C.,Sca	01	02	03	0.12
*Spilosma erythrozone (*Koll)	L.,Arc	-	06	06	0.25
Spilosma sp	L.,Arc	09	10	19	0.79
Total		1193 (50.06)	1190 (49.95)	2383	

Epilachna sp. (Coccinellid), *Anolmola rufiventris* (Scarabaeid), *Lacon modestus* (Elaterid), *Hilyotrogus holosericeus* (Scarabaeid), *Lemyra sp.* and *Spilosma sp.* (Arctiid). The least abundant species trapped with one representative individual were: *Amsacta lactinea* (Arctiid), *Boarmia sp.* (Geometrid), *Caponodis milaris* (Buprestid), *Catacola prolifica* (Noctuid), *Lophosternus hugeli* and *Macrotoma crenata* (Cerambycid), *Plusia orichalcea* and *Prospalta sp.* (Noctuid) and *Serica sp.* (Scarabaeid) (Table 4)

The most dominant insect pest recorded is the *Mythimina* sp. It is a pest of agricultural importance, captured through fluorescent light at Pahalgam Study Site The overall catch of this insect pest was major about 16.99% through different months of summer and autumn season, and its peak activity was recorded in the month of August, with total catch of the month of August as 10.49% During 2003 the aforementioned pest was least active through out the experimental period with total catch of 1.46% Another insect found in abundance was *Adoretus* sp. known to damage *Brassicas* (vegetables) and fruits, etc., represented by 9.81% however, its peak activity has been recorded in the month of July during both the years

Another dominant insect was *Porthesia xanthorrhoea* of agricultural importance trapped showed 8.60% individuals during 2002-2003, showing their peak activity in the July month of summer season. Yet another dominating insect pest of horticultural and agricultural importance was detected as *Adoretus cribratus,* 6.75%. The pest was active from July to September, with peak activity in former month (60 individuals) .Details of insectlight-trapping through different months and seasons 2002-2003 are given in the (Table 4)

The analysis of trapped insect material during June, 2002 to November 2003 (spring, summer and autumn) has revealed a total of 2383 insect individuals pertaining to agricultural importance and those attacking economically important plants of region, spread over 5 orders, *viz*., Coleoptera, Hemiptera, Homoptera, Orthoptera and Lepidiptera, covering 16 families, incorporating 37 genera covering 54 species Table 3

Among the various families trapped, Scarabaeidae was found to be the most dominant family, with 597 individuals, comprising a total of 16 species. The next dominant family with respect to species trapped is in the order as Noctuidae 9 species., Arctiidae 6 species., Cerambycidae, Elateridae, Pentatomidae, Cicadidae, Lymantriidae and Saturniidae, having 2 species each. Rest of the families like Coccinellidae, Meloidae, Miridae, Acrididae and Geometridae having 1 species each. A total of 54 species covering 37 genera captured during the year 2002-2003, are presented in the Table 2**.**

The detailed trapping of insects through light-trap during the year 2002-2003 has captured a total of 2383 individuals, belonging to 37 genera incorporating 54 species. These economically important species are belonging to 16 families, pertaining to five orders. The order Coleoptera was found most dominant order comprising 52.79% of the overall catch during the year 2002 & 2003, with respect to individuals, families and species respectively. The total number of identified species of agricultural importance, including some damaging economically important plants, collected from light-trap, belonging to five insect orders are : Coleoptera(24 species), Lepidoptera (22 species), Hemiptera (5 species), Homoptera(02 species) and Orthoptera (01 species). Table 4

Thus from the available data it has been concluded that light-trapping has provided valuable information and baseline data on the seasonal flight activity of insects associated with major cropping system of Kashmir Himalayan region and this study will help in future surveillance of IPM programme.

Table 4:- Insect pests captured during June - November, 2002 and March – November 2003, using fluorescent light trap at Pahalgam (J&K)

Name of the insect Order, family, Genus and species	Number of insect individuals trapped															
	June	July	August	September	October	November	March	April	May	June	July	August	September	October	November	% catch
Coleoptera																
Buprestidae																
*Caponodis miliaris (*Klug.)	-	01	-	-	-	-	-	-	-	-	-	-	-	-	-	0.04
Coccinellidae																
Epilachna sp.	-	-	20	30	10	-	-	-	-	-	02	15	17	01	-	3.98
Elateridae																
Lacon modestus (Fair.)	-	17	22	01	-	-	-	-	-	-	10	05	-	-	-	2.30
Lacon sp.	-	25	10	-	-	-	-	-	-	-	14	06	01	-	-	2.34
Cerambycidae																
Aeolesthes sarta (Solsky)	-	-	-	-	-	-	-	-	-	02	-	-	-	-	-	0.08
Lophosternus hugely (Redt.)	-	-	01	-	-	-	-	-	-	01	-	-	-	-	-	0.08
Meloidae																
Cyaneolytta spp.–(II)	-	03	03	-	-	-	-	-	-	-	02	01	-	-	-	0.37
Scarabaeidae.																
Adoretus cribratus (White)	-	60	15	11	-	-	-	-	-	-	45	22	08	-	-	6.75
Adoretus sp.	-	141	93	-	-	-	-	-	-	44	192	60	-	-	-	22.24
*Anomala rufiventris (*Hope)	-	39	18	01	-	-	-	-	-	-	15	09	-	-	-	3.44
*Anomala stoliezkoe (*Hope)	-	-	01	06	-	-	-	-	-	-	-	02	-	-	-	0.37
Aserica spp.	-	-	25	-	-	-	-	-	-	5	15	6	-	-	-	2.14
Brahmina coriacea (Hope)	01	-	-	-	-	-	-	-	16	29	29	05	-	-	-	3.35
Brahmina conrata (Blunch)	-	-	2	3	-	-	-	-	-	4	13	2	-	-	-	1.00
Brahmina sp.	-	4	2	-	-	-	-	-	-	1	8	3	-	-	-	0.75
Heteronychus robustus (Redt.)	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	0.04
Hilyotrogus holoserceus (Hope)	01	7	-	-	-	-	-	-	-	5	20	-	-	-	-	1.38
*Melolontha furcicanda (*Anst.)	-	5	3	-	-	-	-	-	-	2	7	1	-	-	-	0.75
*Melolontha melolontha (*Hope)	-	-	-	-	-	-	-	-	-	4	5	4	4	3	-	0.83
*Oryctes nasicornis (*Hope)	-	2	-	-	-	-	-	-	-	-	2	-	-	-	-	0.16
*Oryctes rhinoceros (*Linn.)	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	0.16
Serica sp.	-	1	-	-	-	-	-	-	-	-	2	-	-	-	-	0.12
Hemiptera																
Lygaeidae.																
Calocoris stollozkanus	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	0.12
Pharyllus pistacinus	-	8	6	-	-	-	-	-	-	-	-	-	-	-	-	0.58

Table 4 Contd. .....

Table 4 Contd. .....

Miridae *Lygus sp.*	-	4	15	6	-	-	-	-	-	-	-	4	2	-	-	1.30
Pentatomidae *Euschistus conspersus*	-	3	7	-	-	-	-	-	-	-	12	9	3	2	-	1.51
Euschistus sp.	-	2	3	-	-	-	-	-	-	-	-	7	-	-	-	0.50
Hompptera Cicadidae *Pycna repanda*	-	-	2	4	-	-	-	-	-	-	-	14	65	3	-	3.69
Sena sp	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	0.08
Lepidoptera Arctiidae *Amsacta (=Aloa) lactinea* (Crammer)	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	0.08
Callimorpha principalis (Koll.)	-	4	-	-	-	-	-	-	-	-	3	7	-	-	-	0.58
Cladarctia quadriramosa (Koll.)	-	-	2	-	-	-	-	-	-	-	5	2	-	-	-	0.37
Lemyra sp.	-	8	6	-	-	-	-	-	-	-	2	10	1	-	-	1.13
Spilosoma sp.	-	2	4	2	1	-	-	-	-	-	6	3	1	-	-	0.79
*Spilosoma erythrozone (*Koll.)	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-	0.25
Geometridae *Boarmia* sp	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	0.04
Eummelea sp.	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	0.04
Lymantridae *Euproctis vitellina (*Koll.)	-	2	1	-	-	-	-	-	-	-	23	59	8	-	-	3.90
*Euproctis (= Prothesia) xanthorhoea (*Koll)	-	63	-	-	-	-	-	-	-	-	7	113	22	-	-	8.60
*Dasychira grotei. (*Moore)	-	-	5	3	-	-	-	-	-	-	-	-	-	-	-	0.33
Noctuidae *Agrotis biconica (*Schiff.)	-	4	6	-	-	-	-	-	-	4	4	2	2	-	-	0.92
*Agrotis ipsilon (*Fabr.)	16	3	-	-	-	-	-	-	-	8	4	6	-	-	-	1.55
Agrotis spp.-(1II)	-	-	-	-	-	-	-	-	-	1	11	11	3	-	-	1.09
Cuculia albipennis (Hampson)	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	0.12
Hadena perdentata (Schiff)	-	-	-	-	-	-	-	-	-	-	8	6	4	-	-	0.75
Mythimina sp	-	88	250	29	38	-	-	-	-	-	14	19	2	-	-	18.16
*Ophiusa arcuata (*Moore)	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	0.12
Saturniidae *Antheraea paphia (*Linn.)	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	0.04
Antheraea sp.	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	0.04
Orthoptera Acrididae *Acrida sp.*	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	0.12
Total / Per cent catch in parenthesis	18 (0.75)	504 (21.14)	526 (22.07)	96 (4.02)	49 (2.05)	-	-	-	16 (0.67)	110 (4.61)	493 (20.68)	416 (17.45)	146 (6.12)	09 (0.37)	-	

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