

STUDIES ON PHYTOPHAGOUS WHITEGRUBS OF HIMACHAL PRADESH

THESIS

By

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(A-2009-40-04)

Submitted to



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PALAMPUR – 176 062 (H.P.) INDIA**

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(ENTOMOLOGY)**

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CERTIFICATE – I

This is to certify that the thesis entitled, “**Studies on phytophagous whitegrubs of Himachal Pradesh**” submitted in partial fulfilment of the requirements for the award of the degree of **Doctor of Philosophy (Agriculture)** in the discipline of **Entomology** of CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur is a bonafide research work carried out by **Mandeep Pathania (Admn. No. A-2009-40-04)** son of Smt. Veena Devi and Shri Sakreem Chand Pathania, under my supervision and that no part of this thesis has been submitted for any other degree or diploma.

The assistance and help received during the course of this investigation have been fully acknowledged

Place : Palampur
Dated : 1st, January, 2014

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CERTIFICATE- II

This is to certify that the thesis entitled “**Studies on phytophagous whitegrubs of Himachal Pradesh**” submitted by **Mandeep Pathania** (Admission No. **A-2009-40-04**) son of Shri Sakreem Chand Pathania to the CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur in partial fulfillment of the requirements for the degree of **Doctor of Philosophy (Agriculture)** in the discipline of **Entomology** has been approved by the Advisory Committee after an oral examination of the student in collaboration with an External Examiner.

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(Mandeep Pathania)

TABLE OF CONTENTS

Chapter	Title	Page
1.	INTRODUCTION	1-4
2.	REVIEW OF LITERATURE	5-41
3.	MATERIALS AND METHODS	42-55
4.	RESULTS AND DISCUSSION	56-223
5.	SUMMARY AND CONCLUSIONS	224-233
	LITERATURE CITED	234-258
	BRIEF BIODATA OF THE STUDENT	

LIST OF ABBREVIATIONS USED

Sr. No.	Abbreviation/Symbols	Meaning
1.	amsl	Above mean sea level
2.	<i>coitu</i>	in copulation
3.	E	East
4.	etc.	Etcetera
5.	et al.	Et alii (and others)
6.	Fig	Figure
7.	ft	Feet
8.	FYM	Farm Yard Manure
9.	<i>i.e.</i>	id est (that is)
10.	m	Meter
11.	mm	Milimetre
12.	N	North
13.	no.	Number
14.	P	Page
15.	PDS	Potato Development Station
16.	PCDO	Progeny cum Demonstration Orchard
17.	sp.	Species
18.	SE	Standard Error
19.	sq.	square
20.	<i>viz.</i>	Vi delicet (namely)
21.	°	Degree
22.	"	Seconds
23.	'	Minutes
24.	=	Equal
25.	%	Per cent
26.	/	Per
27.	±	Plus or minus
28.	&	and
29.	*	Asterisk
30.	Σ	Summation
31.	>	More than
32.	<	Less than
33.	\geq	More than equal to
34.	♂	Male
35.	♀	Female
36.	H'	Shannon's index of diversity
37.	D	Simpson's index of diversity
38.	1/D	Simpson's reciprocal index
39.	J'	Pielou's evenness index

LIST OF TABLES

Table No.	Title	Page
3.1	Location details for light trap studies in Himachal Pradesh during 2011 and 2012	43
3.2	Description of sampling locations for beetles on host trees during 2011 and 2012	46
3.3	Description of locations surveyed for whitegrubs in Himachal Pradesh during 2011 and 2012	51
4.1	Check list of scarabaeid beetles collected on light trap during 2011 and 2012 in Himachal Pradesh	57
4.2	Abundance and frequency of scarabaeid beetles on light trap at Palampur	59
4.3	Category-wise frequency distribution of scarabaeid beetles on light trap at Palampur	60
4.4	Diversity indices calculated for light trap catches of scarabs at Palampur	61
4.5	Abundance and frequency of scarabaeid beetles on light trap at Kullu	62
4.6	Category-wise frequency distribution of scarabaeid beetles on light trap at Kullu	64
4.7	Diversity indices calculated for light trap catches of scarabs at Kullu	64
4.8	Abundance and frequency of scarabaeid beetles on light trap at Dallash	66
4.9	Category-wise frequency distribution of scarabaeid beetles on light trap at Dallash	67
4.10	Diversity indices calculated for light trap catches of scarabs at Dallash	67
4.11	Abundance and frequency of scarabaeid beetles on light trap at Shillaroo	69
4.12	Category-wise frequency distribution of scarabaeid beetles on light trap at Shillaroo	70
4.13	Diversity indices calculated for light trap catches of scarabs at Shillaroo	70
4.14	Abundance and frequency of scarabaeid beetles on light trap at Kheradhar	71
4.15	Category-wise frequency distribution of scarabaeid beetles on light trap at Kheradhar	72
4.16	Diversity indices calculated for light trap catches of scarabs at Kheradhar	73
4.17	Abundance and frequency of scarabaeid beetles on light trap at Kwagdhar	75
4.18	Category-wise frequency distribution of scarabaeid beetles on light trap at Kwagdhar	76

Table No.	Title	Page
4.19	Diversity indices calculated for light trap catches of scarabs at Kwagdhar	76
4.20	Abundance and frequency of scarabaeid beetles on light trap at Bharmour	77
4.21	Category-wise frequency distribution of scarabaeid beetles on light trap at Bharmour	78
4.22	Diversity indices calculated for light trap catches of scarabs at Bharmour	79
4.23	Abundance and frequency of scarabaeid beetles on light trap at Reckong Peo	80
4.24	Category-wise frequency distribution of scarabaeid beetles on light trap at Reckong Peo	82
4.25	Diversity indices calculated for light trap catches of scarabs at Reckong Peo	82
4.26	Species check list of defoliating beetles collected on host trees during 2011-12 in Himachal Pradesh	88
4.27	Relative abundance of different species of defoliating beetles on host trees at Palampur	89
4.28	Diversity indices calculated for host tree catches of scarabs at Palampur	91
4.29	Host tree preference by adult chafers, May-August 2011 and 2012 at Palampur	93
4.30	Leaf defoliation by scarab beetles at Palampur during 2011 and 2012	94
4.31	Relative abundance of different species of defoliating beetles on host trees at Kullu	95
4.32	Diversity indices calculated for host tree catches of scarabs at Kullu	96
4.33	Host tree preference by adult chafers, March-August 2011 and 2012 at Kullu	98
4.34	Leaf defoliation by scarab beetles at Kullu during 2011 and 2012	99
4.35	Relative abundance of different species of defoliating beetles on host trees at Dallash	100
4.36	Host tree preference by adult chafers, May-August 2011 and 2012 at Dallash	100
4.37	Diversity indices calculated for host tree catches of scarabs at Dallash	101
4.38	Leaf defoliation by scarab beetles at Dallash during 2011 and 2012	102
4.39	Relative abundance of different species of defoliating beetles on host trees at Nauni	103
4.40	Diversity indices calculated for host tree catches of scarabs at Nauni	104
4.41	Host tree preference by adult chafers, May-August 2011 and 2012 at Nauni	105
4.42	Leaf defoliation by scarab beetles at Nauni during 2011 and 2012	106

Table No.	Title	Page
4.43	Relative abundance of different species of defoliating beetles on host trees at Shillaroo	107
4.44	Diversity indices calculated for host tree catches of scarabs at Shillaroo	108
4.45	Host tree preference by adult chafers, June-August 2011 and 2012 at Shillaroo	109
4.46	Leaf defoliation by scarab beetles at Shillaroo during 2011 and 2012	111
4.47	Relative abundance of different species of defoliating beetles on host trees at Kheradhar	111
4.48	Diversity indices calculated for host tree catches of scarabs at Kheradhar	112
4.49	Host tree preference by adult chafers, May-August 2011 and 2012 at Kheradhar	113
4.50	Leaf defoliation by scarab beetles at Kheradhar during 2011 and 2012	114
4.51	Relative abundance of different species of defoliating beetles on host trees at Kwagdhar	115
4.52	Diversity indices calculated for host tree catches of scarabs at Kwagdhar	115
4.53	Host tree preference by adult chafers, March-August 2011 and 2012 at Kwagdhar	116
4.54	Leaf defoliation by scarab beetles at Kwagdhar during 2011 and 2012	118
4.55	Relative abundance of different species of defoliating beetles on host trees at Bharmour	119
4.56	Diversity indices calculated for host tree catches of scarabs at Bharmour	120
4.57	Host tree preference by adult chafers, June-August 2011 and 2012 at Bharmour	121
4.58	Leaf defoliation by scarab beetles at Bharmour during 2011 and 2012	122
4.59	Relative abundance of different species of defoliating beetles on host trees at Reckong Peo	122
4.60	Diversity indices calculated for host tree catches of scarabs at Reckong Peo	123
4.61	Host tree preference by adult chafers, June-August 2011 and 2012 at Reckong Peo	124
4.62	Leaf defoliation by scarab beetles at Reckong Peo during 2011 and 2012	125
4.63	Whitegrub infestation and their abundance in potato fields, 2011 and 2012	144
4.64	Whitegrub infestation and their abundance in Ginger fields, 2011 and 2012	148

Table No.	Title	Page
4.65	Whitegrub infestation and their abundance in Pea fields, 2011 and 2012	149
4.66	Whitegrub infestation and their abundance in Rajmash fields, 2011-2012	151
4.67	Whitegrub infestation and their abundance in Summer Vegetables, 2011 and 2012	154
4.68	Whitegrub infestation and their abundance in Cole Crops, 2011 and 2012	155
4.69	Whitegrub infestation and their abundance in Maize fields, 2011 and 2012	158
4.70	Duration and morphometrics of different stages of <i>Brahmina coriacea</i>	163
4.71	Duration and morphometrics of different stages of <i>Brahmina flavoseicea</i>	168
4.72	Duration and morphometrics of different stages of <i>Holotrichia longipennis</i>	173
4.73	Duration and morphometrics of different stages of <i>Holotrichia sikkimensis</i>	177
4.74	Duration and morphometrics of different stages of <i>Melolontha cuprescens</i>	185
4.75	Duration and morphometrics of different stages of <i>Autoserica phthisica</i>	196
4.76	Duration and morphometrics of different stages of <i>Maladera insanabilis</i>	197
4.77	Duration and morphometrics of different stages of <i>Schizonycha</i> sp. 1	202
4.78	Duration and morphometrics of different stages of <i>Anomala dimidiata</i>	205
4.79	Duration and morphometrics of different stages of <i>Anomala polita</i>	210
4.80	Duration and morphometrics of different stages of <i>Anomala lineatopennis</i>	213
4.81	Duration and morphometrics of different stages of <i>Anomala varicolor</i>	217

LIST OF FIGURES

Fig. No.	Title	Page
3.1	Map showing sampling locations for beetles on light trap and host trees in Himachal Pradesh	47
3.2	Map showing sampling locations for whitegrubs in Himachal Pradesh	50
4.1	Monthwise occurrence of scarabaeid beetles on light trap at Palampur	58
4.2	Monthwise occurrence of scarabaeid beetles on light trap at Kullu	63
4.3	Monthwise occurrence of scarabaeid beetles on light trap at Dallash	65
4.4	Monthwise occurrence of scarabaeid beetles on light trap at Shillaroo	68
4.5	Monthwise occurrence of scarabaeid beetles on light trap at Kheradhar	72
4.6	Monthwise occurrence of scarabaeid beetles on light trap at Kwagdhar	74
4.7	Monthwise occurrence of scarabaeid beetles on light trap at Bharmour	78
4.8	Monthwise occurrence of scarabaeid beetles on light trap at Reckong Peo	81
4.9	Subfamily- wise distribution of scarabaeid beetles on light trap in Himachal Pradesh	83
4.10	Dominant species of scarabaeid beetles on light trap during 2011-12 in Himachal Pradesh	84
4.11	Scarabaeid beetles diversity parameters of eight study sites of Himachal Pradesh on light trap. a) Number of Species, b) total number of beetle specimen, c) Shannon index (H'), d) Simpson's index of diversity (D), e) Simpson's reciprocal index ($1/D$), and f) Pielou's evenness index (J')	86
4.12	Per cent species composition of different species on different hosts during 2011 and 2012 at Palampur	90
4.13	Per cent species composition of different species on different hosts during 2011 and 2012 at Kullu	94
4.14	Per cent species composition of different species on different hosts during 2011 and 2012 at Dallash	99
4.15	Per cent species composition of different species on different hosts during 2011 and 2012 at Nauni	103
4.16	Per cent species composition of different species on different hosts during 2011 and 2012 at Shillaroo	107
4.17	Per cent species composition of different species on different hosts during 2011 and 2012 at Kheradhar	111
4.18	Per cent species composition of different species on different hosts during 2011 and 2012 at Kwagdhar	114
4.19	Per cent species composition of different species on different hosts during 2011 and 2012 at Bharmour	119

Fig. No.	Title	Page
4.20	Per cent species composition of different species on different hosts during 2011 and 2012 at Reckong Peo	123
4.21	Scarabaeid beetles diversity parameters of eight study sites of Himachal Pradesh on host trees. a) Number of Species, b) total number of beetle specimen, c) Shannon index (H'), d) Simpson's index of diversity (D), e) Simpson's reciprocal index (1/D), and f) Pielou's evenness index (J')	129
4.22	Subfamily- wise distribution of scarabaeid beetles on host trees in Himachal Pradesh	131
4.23	Emergence pattern of scarabaeid beetles during 2011-12 in Himachal Pradesh	141
4.24	Monthwise per cent beetle catch of different subfamilies from Himachal Pradesh in 2011 and 2012	141
4.25	Dominant species of scarabaeid beetles on host trees during 2011-12 in Himachal Pradesh	141
4.26	Raster pattern of <i>Brahmina coriacea</i>	166
4.27	Male and female genitalia of <i>Brahmina coriacea</i>	166
4.28	Raster pattern of <i>Brahmina flavosericea</i>	169
4.29	Male and female genitalia <i>B. flavosericea</i>	169
4.30	Raster pattern of <i>Holotrichia longipennis</i>	174
4.31	Male and female genitalia <i>Holotrichia longipennis</i>	174
4.32	Raster pattern of <i>Holotrichia sikkimensis</i>	179
4.33	Male and female genitalia <i>Holotrichia sikkimensis</i>	179
4.34	Raster pattern of <i>Microtrichia cotesi</i>	182
4.35	Male genitalia of <i>Microtrichia cotesi</i>	182
4.36	Raster pattern of <i>Melolontha cuprescens</i>	183
4.37	Raster pattern of <i>Melolontha virescens</i>	188
4.38	Male genitalia of <i>Melolontha virescens</i>	188
4.39	Raster pattern of <i>Lepidiota stigma</i>	191
4.40	Male and female genitalia of <i>Lepidiota stigma</i>	191
4.41	Raster pattern of <i>Autoserica phthisica</i>	194
4.42	Male and female genitalia of <i>Autoserica phthisica</i>	194
4.43	Raster pattern of <i>Maladera insanabilis</i>	199
4.44	Male and female genitalia of <i>Maladera insanabilis</i>	199
4.45	Raster pattern of <i>Schizonyha</i> sp. 1	203
4.46	Male and female genitalia of <i>Schizonyha</i> sp. 1	203
4.47	Raster pattern of <i>Anomala dimidiata</i>	207
4.48	Male and female genitalia of <i>Anomala dimidiata</i>	207
4.49	Raster pattern of <i>Anomala polita</i>	210
4.50	Raster pattern of <i>Anomala lineatopennis</i>	216
4.51	Male and female genitalia of <i>Anomala lineatopennis</i>	216
4.52	Raster pattern of <i>Anomala varicolor</i>	220
4.53	Male and female genitalia of <i>Anomala varicolor</i>	220
4.54	Raster pattern of <i>Phyllognathus dionysius</i>	223

LIST OF PLATES

Plate No.	Title	Page
3.1	UV light trap installed at Palampur (a), and UV light trap in operation at Kwagdhar (b)	44
3.2	Glass jars and chimney sets used for mating and feeding of beetles	53
3.3	Paper cups used for rearing of grubs	53
3.4	Sexing of beetles a) Male beetles b) Female beetles	55
4.1	Defoliation of <i>toon</i> by <i>H. longipennis</i> beetles at Palampur	92
4.2	<i>Schizonycha</i> sp. 1 beetles feeding on pear flowers	97
4.3	Peach plant defoliated by beetles of <i>Autoserica phthisica</i>	97
4.4	Pear plant defoliated by beetles in Kullu Valley	97
4.5	Walnut defoliation by <i>B. coriacea</i> beetles	110
4.6	Apple defoliation by <i>B. coriacea</i> beetles	110
4.7	<i>A. lineatopennis</i> beetles feeding on apple	117
4.8	<i>A. lineatopennis</i> beetles feeding on apple fruits	117
4.9	<i>C. spilota</i> beetles feeding on peach fruits	117
4.10	<i>P. nasuate</i> feeding on rice grains	128
4.11	<i>P. nasuate</i> feeding on maize tassels	128
4.12	Adults of Melolonthinae	133
4.13	Adults of Melolonthinae	134
4.14	Adults of Melolonthinae	135
4.15	Adults of Melolonthinae	136
4.16	Adults of Rutelinae	137
4.17	Adults of Rutelinae	138
4.18	Adults of Cetoniinae	139
4.19	Adults of Dynastinae	140
4.20	Adults of Dynamopodinae	140
4.21	<i>B. coriacea</i> grubs feeding on potato tubers	147
4.22	<i>Melolontha</i> grubs feeding on potato tubers	147
4.23	Tuber damaged by <i>Melolontha</i> grubs	147
4. 24	Ginger rhizomes damaged by whitegrubs	150

Plate No.	Title	Page
4.25	Pea plant damaged by whitegrubs a) Root pruned by grubs, b) Grubs of <i>H. longipennis</i> collected from pea fields	150
4.26	White grub infestation in rajmash a) Wilted plant, b) Healthy plant, c) Grub feeding on roots, d) <i>Melolontha</i> grubs collected from rajmash fields	153
4.27	Infestation of <i>P. dionysius</i> a) Healthy and infested plant of capsicum, b) Grub of <i>P. dionysius</i> feeding on capsicum roots, c) Healthy and infested plant of tomato	156
4.28	White grub infestation in cabbage a) Infested plant, b) Healthy plant, c) Plant showing healthy and pruned roots	159
4.29	White grub infestation in maize a) Healthy and infested plant by <i>L. stigma</i> , b) <i>L. stigma</i> grubs feeding on maize roots, c) Roots pruned by <i>L. stigma</i> grubs, d) Healthy roots, e) <i>P. dionysius</i> grubs feeding on maize, f) Maize field infested by <i>Melolontha</i> grubs	160
4.30	Different stages of <i>B. coriacea</i> , a) Eggs, b) Grubs, c) Earthen cells, d) Prepupae e) Pupa, f) Adults	165
4.31	Different stages of <i>B. flavosericea</i> , a) Eggs, b) Grubs, c) Prepupae d) Pupa, e) Adults	170
4.32	Different stages of <i>H. longipennis</i> , a) Eggs, b) Grub, c) Prepupa d) Pupa, e) Adults	175
4.33	Different stages of <i>H. sikkimensis</i> , a) Eggs, b) Grub, c) Prepupa d) Pupa, e) Adults	178
4.34	Different stages of <i>M. cotesi</i> , a) Eggs, b) Grub, c) Pupa, d) Adults	181
4.35	Different stages of <i>M. cuprescens</i> , a) Eggs, b) Grub, c) Pupa, d) Adults	184
4.36	Different stages of <i>M. virescens</i> , a) Eggs, b) Grub, c) Pupa, d) Adults	187
4.37	Different stages of <i>L. stigma</i> , a) Eggs, b) Grub, c) Earthen cell, d) Pupa, e) Adults	190
4.38	Different stages of <i>A. phthisica</i> a) Eggs, b) Grub, c) Pupa d) Adults, e) Mating pair	195
4.39	Different stages of <i>M. insanabilis</i> , a) Grub, b) Pupa, c) Mating pair, d) Adults	198
4.40	Different stages of <i>Schizonycha</i> sp. 1, a) Eggs, b) Grubs, c) Pupa, d) Mating pair, e) Adults	201
4.41	Different stages of <i>A. dimidiata</i> , a) Eggs; b) grub, c) earthen cell d) pupa, e) Adults	208
4.42	Different stages of <i>A. polita</i> , a) Eggs, b) Grub, c) Prepupa d) Pupa, e) Adults	211
4.43	Different stages of <i>A. lineatopennis</i> , a) Eggs, b) Grubs, c) Prepupa d) Pupa, e) Adults, f) Mating pair	214
4.44	Different stages of <i>A. varicolor</i> , a) Eggs, b) Grub, c) Pupa, d) Adults	219
4.45	Different stages of <i>P. dionysius</i> , a) Eggs, b) Grub, c) Prepupa, d) Adults	222

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ABSTRACT

The scarabaeid beetles were collected on UV light traps and directly from host trees in Himachal Pradesh during 2011 and 2012. The light trap studies were conducted at Palampur, Kullu, Dallash, Shillaroo, Kheradhar, Kwagdhara, Bharmour and Reckong Peo. A total of 55 species were collected on light trap and five most common species were *Brahmina coriacea*, *Adoretus lasiopygus*, *Anomala lineatopennis*, *Maladera insanabilis* and *Holotrichia longipennis*. They comprised 9.88-10.05, 7.18-7.76, 7.13-7.27, 6.80-7.62 and 5.22-5.30 per cent during 2011-12, respectively. The value of Shannon index (H') was found to be maximum (H'=3.01-3.03) at Palampur and the value of Pielou's evenness index (J') ranged from 0.89-0.90. These values indicate maximum evenness and abundance of species at Palampur. The Shillaroo area had the lowest Shannon index (H'=1.12-1.17) and Pielou's evenness index (J'=0.46-0.49). This showed least species diversity and higher unevenness of scarabaeid beetles at Shillaroo which is due to the sole dominance of *B. coriacea*. On host trees, altogether 78 species were collected from 11 districts of Himachal Pradesh. On the basis of size of population, five dominant species in Himachal Pradesh were *B. coriacea* (48.4%), *H. longipennis* (9.70%), *Autoserica phthisica* (5.19%), *M. insanabilis* (4.95%) and *Schizonycha* sp. 1 (3.88%) on different host trees. The Shannon index (H') was calculated to be maximum at Nauni (H'=2.48) during 2011 and at Dallash (H'=2.49) during 2012. The Pielou's evenness index was maximum at Dallash (J'=0.88). The value of Shannon index (H'=0.15-0.17) and Pielou's evenness index (J'=0.06-0.07) was calculated to be minimum at Shillaroo. Thus maximum abundance of species was recorded at Dallash, whereas least variation between the species and higher unevenness in population exists at Shillaroo. A total of 86 species were collected on light trap/host trees, and a critical analysis of light trap: host trees data revealed that *B. coriacea* and *H. longipennis* are less phototactic, whereas *M. insanabilis*, *A. lineatopennis* and *A. lasiopygus* are more heliotactic in nature. Data on whitegrub infestation were recorded at 20 locations in crops like potato, ginger, cole crops, peas, maize, capsicum, tomato and rajmash. Maximum tuber damage (40.8-45.6%) in potato due to *B. coriacea* was recorded at Shillaroo, and in ginger, rhizome infestation by grubs of *H. longipennis* was maximum (17.8-20.3%) at Sangrah in Sirmaur district. In rajmash, grubs of *Melolontha* spp. caused damage and there was 21.0-26.3 per cent plant mortality at Baragran at Kangra district during 2011 and 2012, respectively. In peas, maximum whitegrub damage (21.75-25.0%) was recorded at Janjehli in Mandi district. In Jokhari area of Solan district, there was moderate attack of *Phyllognathus dionysius* in capsicum (14.5-19.75%) and tomato (13.2-15.4%). In 'off season' cabbage at Baragran, heavy incidence of *Melolontha* grubs ranging from 28.0-30.7 per cent was recorded. In maize, *Lepidiota stigma* was found to cause damage in alternate years in riverbed areas of Beas river. There was 40.2 per cent plant mortality during 2011 at Kheri village of Hamirpur district. Observations on biology of 16 species of whitegrubs were recorded. *B. coriacea*, *B. flavocericea*, *H. longipennis*, *H. sikkimensis*, *A. phthisica*, *A. dimidiata*, *A. lineatopennis*, *A. varicolor*, *A. polita* completed their life cycle in one year. *Melolontha cuprescens*, *M. virescens* and *L. stigma* had a biennial life cycle, whereas *Schizonycha* sp. 1 completed two generations in a year. In *P. dionysius*, overwintering takes place in adult stage, whereas in all other species, overwintering occurred in larval stage. The rastral patterns have been given for 16 species. The male and female genitalia have been drawn for 13 and 11 species, respectively.

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