STUDIES ON PHYTOPHAGOUS WHITEGRUBS OF HIMACHAL PRADESH

THESIS

By

MANDEEP PATHANIA

(A-2009-40-04)

Submitted to

CHAUDHARY SARWAN KUMAR
HIMACHAL PRADESH KRISHI VISHVAVIDYALAYA
PALAMPUR – 176 062 (H.P.) INDIA

in

Partial fulfilment of the requirements for the degree

of

DOCTOR OF PHILOSOPHY IN AGRICULTURE

(DEPARTMENT OF ENTOMOLOGY)

(ENTOMOLOGY)

2014

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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

(R. S. Chandel)
Major Advisor

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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Needless to say, all omissions and errors are mine.

Place: Palampur

Dated: 1st, January, 2014 ***(Mandeep Pathania)***

TABLE OF CONTENTS

LIST OF ABBREVIATIONS USED

Sr. No.	Abbreviation/Symbols	Meaning
1.	amsl	Above mean sea level
2.	*coitu*	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.e.*	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.	*viz.*	Vi delicet (namely)
21.	º	Degree
22.	"	Seconds
23.	'	Minutes
24.	=	Equal
25.	%	Per cent
26.	/	Per
27.	±	Plus or minus
28.	&	and
29.	*	Asterisk
30.	∑	Summation
31.	>	More than
32.	<	Less than
33.	≥	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

LIST OF FIGURES

LIST OF PLATES

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Title of the thesis	:	Studies on phytophagous whitegrubs of Himachal Pradesh
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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, Kwagdhar, 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 motality during 2011at 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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