International Journal of Engineering, Science and Mathematics
Vol. 8 Issue 6, June 2019,
ISSN: 2320-0294 Impact Factor: 6.765
Journal Homepage: http://www.ijesm.co.in, Email: ijesmj@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A

Pests and predators of *Apismellifera* L. as observed in their colonies in the state of Haryana, India

Dalip Chand & Meera Srivastava

Laboratory of Entomology, Department of Zoology,

Govt. Dungar College, Bikaner, Rajasthan, India,

Abstract

Studies related to the pests and predators of honeybee (*Apismellifera*) in the state of Haryana was conducted during the month of October 2018 to March 2019. A total of 35 apiaries were chosen. Study revealed 32 species of invertebrate and vertebrate pests and predators. Of 16 insect species 7 belonged to order Hymenoptera, 2 to Lepidoptera, 2 to Diptera and 1 each to Coleoptera, Orthoptera, Dictyoptera, Odonata and Thysanura. The Arachnids consists of 8 species belonged to Acarina and 1 species to Pseudoscorpionida. In addition, 2 species of molluscs were also seen invading in honeybee colonies. Honeybee colonies were also invaded by some vertebrate which include 2 species of aves (*Dicrurs* and *Merops*), 1 species of amphibia, reptiles and mammals respectively.

***Key words*:** *Apismellifera*, Apiaries, Acarina, Pests, Predators

Introduction

Being, vital as Pollinators of various agricultural and horticultural crops, honeybees are among the most successful organisms on the planet which are capable of surviving in wide range of climates and environments. They now inhabit most areas of world occupied by human beings (Ellis &Munn, 2005). The characteristics attributed to European bee, which makes *Apismellifera* superior to others are its good honey gathering quality, gentle temperament, less swarming tendency and guard against enemies except wasps (Singh, 1962).

There are several underlying reasons such as poor management practices adopted by beekeepers, weakens the bee colony and various kinds of pests and predators attack these weakened colonies as a result. Whenever this happens, bees use 'sting' as their natural weapon against most of their enemies but sometimes they also seek assistance from

beekeeper to defend (Gulati &Kaushik, 2004). Hence the health of honeybee is of great economic concern around worldwide because honeybee colonies are infested by wide varieties of pests and predators that range from microscopic mites (which may cause disease) to which cause disturbances and nuisance in functioning of entire colony and to large mammals such as bears. Insects, spiders, pseudoscorpions and mites may act as both pests and predators (Morse, 1980; Atwal, 2000). Besides pests, there are also many predators that attack honeybee colonies. Dragonflies and certain spiders have been observed feeding directly on adult bees (Mishra, 1995; Mishra and Garg, 1997). Amongst predators, wasps and hornets pose most serious threat to bee keeping industry (Gochnauer&Shimanuki, 1992). Wasps are either semi social or social insects, being predacious by nature, catch bees from the blossoms or at the entrances of the hives (Spradbery, 1990). Honeybee enemies include wax-moths, birds, wasps, mites, ants, bee lice, hive beetles, mice, skunks and bear (Morbe, 1999).

Cockroaches, Death's head moth, robberflies, dragonflies, praying mantis, spiders are some minor pests which cause nuisance into bee colonies (Thakur and Sharma, 1984). Keeping this in view, present research article is an attempt to enlist pests and predators of European bee *Apismellifera* in the state of Haryana.

Material and method

Apiaries surveyed

A comprehensive survey of different pests and predators infesting/attacking European hive bee, *Apismellifera* was made in apiaries of four districts of Haryana. In all, 35 apiaries were surveyed in the month of October 2018 to March 2019. Haryana is a state in northern India lying between 27º39' to 30º35' N latitude and 74º28' and 77º36' E longitudes. The altitude of Haryana varies between 200 m to 1200 m above sea level. The surveyed apiaries were located in districts of Yamunanagar [Yamunanagar city (283m), Manakpur (260 m), Sheikhpura (256 m)]; Kurukshetra [Kurukshetra city (258 m), Pipli (257 m), Dheerpur (211 m)]; Kaithal [Kaithal city (240m), Gohran (238 m), KheriGulamali (239 m), Kakeri (245 m), Nagal (327 m)] and Karnal [Gheer (255 m), Choura (255 m)], (Fig-1).

Fig-1:Apiaries surveyed at different locations in Haryana state during the present study.

Collection of pests and predators

Collection of different pests and predators infesting/attacking honeybee colonies (*Apis* spp.) in 35 experimental apiaries were sampled by Hand Picking Method, Sweeping Method and Aerial Netting Method. Soft bodied hymenopterans were collected from body of honeybee larvae by hand picking method while Lepidoptera and Hymenoptera related pests and predators were collected by sweeping method. Aerial netting method was used to collect insect pests mainly belonging to Hymenoptera, Lepidoptera and Diptera. Insects collected by aerial netting method were then killed with the help of killing bottle. Analysis of brood mites of European honeybee was done by examining 50-100 capped drone and worker. Examination of adult bees was done by brushing 250-300 worker bees into plastic sample tubes containing 80 per cent alcohol. The filtered material was then examined under microscope. Deformed winged bees, missing legs and bees crawling rather than flying indicate the presence of mites (Sharma *et al.*, 2011c). 80 to 100 of bees of European bee were collected from each colony and their heads, abdomen, legs and wings of these bees were removed in order to get separate thoraces and treated with 10 per cent KOH solution for about 24 hours. Thoraces were washed in running tap water and these then observed for presence of mites under a research binocular (Kumar & Ambrose, 1990).

Identification of pests and predators

The identification of honeybee pests and predators was done with the earlier records of Acarology, Research laboratory and Sociobiology and Behavioural Ecology Research, Department of Biosciences, Himachal Pradesh University, Shimla. All the collected insect pests and predator specimens were killed, stretched and pinned properly. These were later

confirmed by the Entomologists and Taxonomists of Dr. Y. S. Parmar University of Horticulture and Forestry, Solan, Himachal Pradesh and their associated College branch situated at Neri (Hamirpur), Himachal Pradesh and Zoological Survey of India (ZSI), New Delhi.

Results and discussion

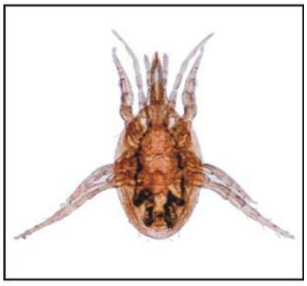
Pests and predators of *A. mellifera* colonies in 35 apiaries of four districts of Haryana are presented in Table-I. Studies revealed 32 species of invertebrates and vertebrate pests and predators. Of 16 insect species 7 belonged to order Hymenoptera, 2 to Lepidoptera, 2 to Diptera and 1 each to Coleoptera, Orthoptera, Dictyoptera, Odonata and Thysanura. Of arachnids 8 species belonged to Acarina and 1 to Pseudoscorpionida. Besides arachnids and insects 2 species of molluscs were also seen invading in bee colonies. Not only invertebrates but honeybee colonies were also invaded by some vertebrate pests and predators which include 2 species of birds (*Dicrurus* and *Merops*), 1 amphibian, reptile and mammal respectively.

Among insects, wasps were the most serious threat and abundant predators attacking the colonies of *Apismellifera* in Haryana. Behavioural traits and body size of different *Vespa* species are presented in Table-II. Present studies revealed 5 species of wasps viz. *Vespaorientalis* L., *Vespatropica* V., *Vespamandarina* S., *Vespaauraria* S. and *Vespabasilis* S. Of these, *Vespaorientalis* L., *Vespaauraria* S. and *Vespamandarina* S. were the most prevalent in Haryana. In addition to wasps, 2 species of ants (*Formicafusca* L. and *Camponotuscompressus* F.); 2 species of wax-moths (*Galleriamellonella* L. and *Achroiagrisella* F.), 2 species of flies (*Lucilia* sp. and *Calliphora* sp.), 1 species each of beetle (*Platyboliumalvearium*), cockroach (*Blatta* sp.), dragonfly (*Coengrionpuella*), *Lepisma* sp. were seen invading in the colonies of honeybee in Haryana. In addition, 1 species of pseudoscorpion (*Chelifer* sp.) belonging to Arachnida were also seen in honeybee colonies.

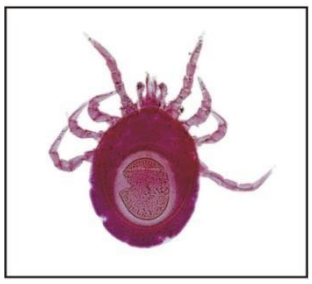
Mite pests of honeybees revealed a total of 8 species belonging to 6 families of subclass Acari who infested bee colonies in Haryana were: *Varroadestructor* Anderson and Trueman, *Tropilaelapsclareae*Delfinado and Baker, *Macrocheles* (ii-iii), *Neocypholaelapsapicola*Delfinado and Baker, *Neocypholaelapsindica* Evans, *Acarapisdorsalis*Morgenthalar and *Tyrophaguslongior* Gervais (Fig-2). Based on percentage composition according to different classes of pests and predators class Insecta

(50%) was the most dominating followed by Arachnida (28%), Gastropoda (7%), Aves (6%) while Amphibia, Reptilia and Mammalia include (3% each) (Fig- 3).

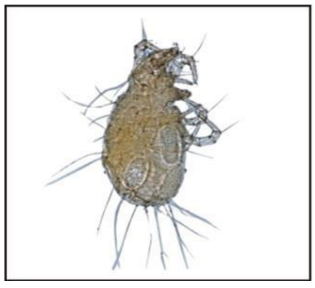
Ectoparasitic mite, *Tropilaelapsclareae*



Predatory mite,*Macrocheles sp.(ii)*



Phoretic mite,*Neocypholaelapsapicola*



Phoretic mite, *Tyrophaguslongior*

Fig-2: Different mite pests attacking *A. mellifera* colonies in Haryana state.

Table 1.Pests and predators infesting/attacking in the colonies of *Apismellifera* in the State of Haryana, India

INVERTEBRATES						**VERTEBRATES**	
Arthropoda (Class Insecta)				**Mollusca**		**Chordata**	
I	**Order Lepidoptera**	**Arachnida**		**Class Gastropoda**		**Amphibia**	
1	*Galleria mellonella* L.	**IX**	**Order Pseudoscorpionida**	**XIII**	**Order Stylommatophora**	**XIV**	**Order Anura**
2	*Achroiagrisella* F.		**Family Cheliferidae**		**Family Ariophantidae**		**Family Bufonidae**
II	**Order Hymenoptera**	17	*Chelifer*Sp.	26	*Limax* sp.	28	*Bufo* sp.
	Family Vespidae	**X**	**Order Mesostigmata**	27	Snail		
3	*Vespa orientalis* L.		**Family Varroidae**				**Reptilia**
4	*Vespa tropica*Vecht.	18	*Varroa destructor* Anderson and Trueman			**XV**	**Order Squamata**
5	*Vespa mandarina* S.		**Family Laelapidae**				**Suborder Lacertila**
6	*Vespa auraria* S.	19	*Tropilaelapsclareae*Delfinado& Baker			29	*Hemidactylus* sp.
7	*Vespa basalis* S.		**Family Macrochelidae**				
	Sub Family formicinae	20	*Macrocheles species (ii)*				**Aves**
8	*Formica fusca* L.	21	*Macrochelis*species (iii)			**XVI**	**Order Passeriformes**
9	*Camponotuscompressus* F.		**Family Ameroseiidae**				**Family Dicrudidae**
III	**Order Diptera**	22	*Neocypholaelapsapicola*Delfinado-Baker			30	*Dicrurusmacrocerus*
	Family Calliphoridae	23	*Neocypholaelapsindica*Evans			**XVII**	**Order Coraciiformes**
10	*Lucilia*sp.	**XI**	**Order Prostigmata**				**Family Meropidae**
11	*Calliphora* sp.		**Family Tarsonemidaeh**			31	*Meropsorientalis*
IV	**Order Coleoptera**	24	*Acarapis dorsalis*Morgenthalar				
	Family Tenebrionidae	**XII**	**Order Astigmata**			**XVIII**	**Mammals**
12	*Platyboliumalvearium*		**Family Acaridae**				**Order Rhodentia**
V	**Order Orthoptera**	25	*Tyrophaguslongior* Gervais			32	*Rattusrattus*
	Family Mantidae						
13	*Mantis* sp.						
VI	**Order Dictyoptera**						
	Family Blattidae						
14	*Blatta* sp.						
VII	**Order Odonata**						
15	*Coengrionpuella* (DragonFly)						
VIII	**Order Thysanura**						
16	*Lepisma* sp.						

Table 2.Behavioural traits and body size of different *Vespa* spp. attacking *A. mellifera* L. colonies in different apiaries of Haryana

Sr .No.	Common Name	Scientific Name	Body size (cm)	Colour of Abdomen	Nature	Peak Period of Attack
1	Yellow Wasp	***Vespa orientalis* L.**	2.24-2.56	Yellow bands alternating with brown bands	Solitary	September – October
2	Yellow Wasp	***Vespa tropica* V.**	2.90-3.10	Yellow bands alternating with black bands	Gregarious	September – November
3	Giant Wasp	***Vespa mandarina*S.**	3.24-3.36	Dark brown alternating with yellow bands and interspersed with light yellow bands	Solitary	August – October
4	Golden Wasp	***Vespa auraria* S.**	2.65-2.82	Brown with yellow bands	Gregarious	July- October
5	Black Wasp	***Vespa basalis* S.**	2.25-2.50	Completely black in colour	Solitary	October – November

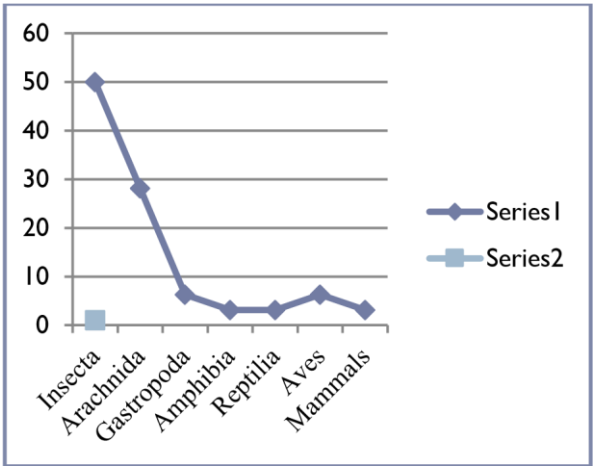


Fig-3: Percentage composition according to different classes of pests and predators.

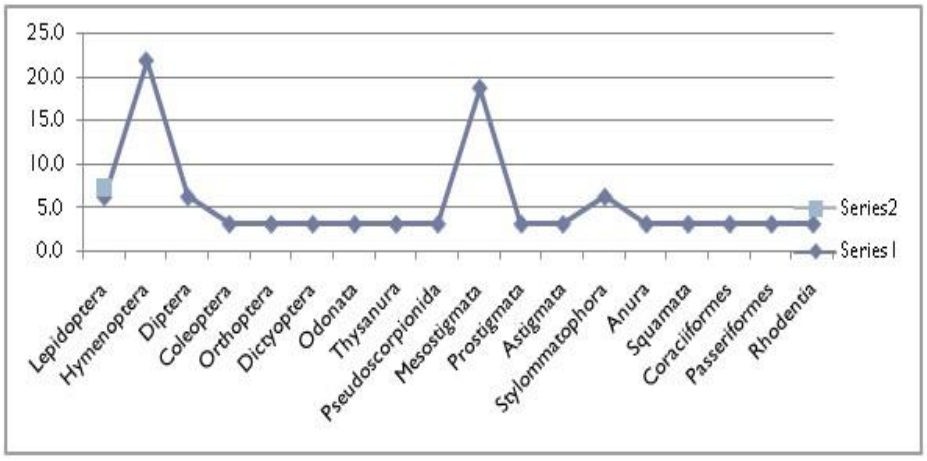


Fig- 4: Percentage composition according to different orders of pests and predators

According to percentage composition of different orders, the most distributed species of pests and predators related to order Hymenoptera (22%), followed by order Mesostigmata (19%), Lepidoptera, Diptera, Stylommatophora (6% each), Coleoptera, Orthoptera, Dictyoptera, Odonata, Thysanura, Pseudoscorpionida, Prostigmata, Astigmata, Anura, Squamata, Coraciiformes, Passeriformes and Rhodentia (3% each) (Fig-4). These results are in accordance with the earlier findings of Gulati & Kaushik, (2004) and Anonymous (2006) who also found robberflies, dragonflies, praying mantis and cockroaches as the common insect enemies of honeybees in India. Sharma (2009), Sharma (2011) and Abrol(2011) also found similar species of insect pests and predators of honeybees in Himachal Pradesh as well as in Jammu and Kashmir respectively. Sharma et al. (2013)made similar studies regarding diversity and distribution of pests and predators of honeybees in Himachal Pradesh. Studies related to the seasonal variation of *Vespaauraria* S. and *Vespamandarinia* S. attacking *Apismellifera* L. colonies in district Kangra of Himachal Pradesh were carried out by Mattu&Sharma (2017) and revealed *V.auraria* and *V. mandarinia* attack on *A. mellifera* varied with season but were more during the floral dearth period. Chandra &Mattu, (2017) made similar study on major pests and predators of honeybees in Chamba valley of Himachal Pradesh and revealed 36 species of pests and predators which cause considerable damage to honeybees.

Conclusion

Based on present studies and earlier findings by various investigators it can be concluded that predatory wasps, mites and wax-moths pose serious problems to beekeeping industry in Haryana state. To protect honeybees from pests and predators begins with a strong colony that can defend itself. Proper management practices such as to keep bee colonies healthy and strong, kill wasps by flyflappers during the peak period of their attack and use of combination of biomechanical as well as chemical methods should be adopted.

References

Abrol, D.P. 2011. Pests, Pathogens and Predators of honeybees in India with special reference to Jammu and Kashmir. In: Prospects and promotion of apiculture for augmenting hive and crop productivity (eds.: Chhuneja*et al*.), Ludhiana, 115-128.

Anonymous 2006. Honeybee diseases and pests: A practical guide, pp. 33.

Atwal, A.S. 2000. Essentials of beekeeping and pollination. Kalyani publishers, New Delhi, pp. 394.

Chandra, A. &Mattu, V.K. 2017. Studies on major pests and predators of *Apiscerana* F. and *Apismellifera* L. in the Chamba valley of Himachal Pradesh. *Journal of Entomology andZoology Studies*, 5(6), 728-731.

Ellis, J.D. & Munn, P.A. 2005. The worldwide health status of honeybees. *Bee World*, 86(4), 88-101.

Gochnauer, T.A., Furgala, B. &Shimanuki, H. 1992. Diseases and enemies of honeybees. In: The hive and honeybee (eds: Dadant and sons). Hamilton, Illinois, 615-653.

Gulati, R. & Kaushik, H.D. 2004. Enemies of honeybees and their management-A Review, 25(3), 189-200.

Komielli, A.B. & Ambrose, J.T. 1990. Biology, ecology and damage of tracheal mites on honeybee (*Apismellifera*). *Am. Bee J.*, 193-199.

Mattu, V.K. & Sharma, I. 2017. Seasonal variation of *Vespa auraria* S. and *Vespa mandarinia* S. (Hymenoptera: Vespidae) attacking *Apismellifera* L. colonies in district Kangra of Western Himalayas, Himachal Pradesh (India). *Journal of Entomology andZoology Studies*, 5(3), 1862-1864.

Mishra, R.C. 1995. Honeybee and their management in India. *ICAR*, New Delhi, pp. 168.

Mishra, R.C. & Garg, I.D. 1997. Perspectives in Indian Apiculture. *Agro Botanica*, Vikas Nagar, Bikaner, pp. 412.

Morbe, R.A. 1999. Honeybee pests, predators and diseases. *University Cornell Press*, Ithaca, New York, USA.

Morse, R.A. 1980. Honeybee pests, predators and diseases. *Cornell University Press*, Ithaca, London.

Sharma, I. 2011. Studies on pests and predators of *Apiscerana* F. and *Apismellifera* L. in Kangra and adjoining areas of Himachal Pradesh. M.Phil. thesis submitted to Himachal Pradesh University, Shimla, pp. 124.

Sharma, N., Vashisth, S. & Sharma, P.K. 2013. Diversity and distribution of pests and predators of honeybees in Himachal Pradesh, India. *Indian J. Agric. Res.*, 47(5), 392-401.

Sharma, V. 2009. Studies on biology and management of pests and predators attacking honeybee species in Himachal Pradesh. Ph.D. thesis submitted to Himachal PradeshUniversity, Shimla, pp. 198.

Sharma, V., Mattu, V.K. & Thakur, M.S. 2011c. Studies on seasonal variations of ectoparasitic mites on honeybee colonies in Shivalik Hills, Himachal Pradesh. *Int. J. Innov. Bio-Sci.* 1, 2223.

Singh, S. 1962. Beekeeping in India. *IndianCouncil Agric. Res*., New Delhi.

Spradbery, J.P. 1990. Wasps. Sidgwick and Jackson, London.

Thakur, A.K. & Sharma, O.P. 1984. The spider as bee enemies. *Journal of Bombay Natural History Society*, 81, 208-211.