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STUDIES ON PESTS AND DISEASES OF BUMBLE BEE (*BOMBUS HAEMORRHOIDALIS* SMITH) IN INDIA

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ABSTRACT

Bumble bees are wild pollinators and in many countries being reared commercially. In India, attempts are being made for the domestication of bumble bee, *B. haemorrhoidalis*. But targeted rearing success has not been accomplished till now. During the month of June-July, developing colonies start declining leading to the cent per cent loss of the bumble bee population. Keeping in view the immense importance of various pests and diseases of bumble bees in the successful rearing, studies during 2010-2012 were conducted to know the different pests and diseases for better domiciliation and commercialization of the bombiculture in our country. Fecundated queens of bumble bee, *B. haemorrhoidalis* were collected during spring season and were kept in wooden domiciles in the incubator at a temperature 26±1°C and 65-70% relative humidity by feeding with fresh corbicular pollen and sucrose solution. Incidence of pests and diseases was observed with the development of colonies. Dead workers and queens were dissected and slides were prepared to study the causal organism of their death. The pests were found to be nematodes, conopid flies, mites and moths. Similarly, the colonies were also found to be affected with nosema and bacterial diseases. Percent infestation/infection of bumble bee colonies was calculated for each pest and disease. 8.83% colonies were found unaffected and survived till mid August. Bumble bee queens (17.65%) were infected by large number of juveniles and eggs of nematode, *Sphareularia* spp. (Sphaerulariidae). Conopid flies were present in the abdomen of 20.58% queens. Small oval reddish brown mites were located in 11.76% queens. While the brownish grey coloured moths were found to feed on the wax and pollen also caused losses to the 8.83% developing colonies of bumble bees. In 14.70% of queens, numerous nosema spores were found in the mid gut causing infection and finally leading their death. Rod like bacterial cells belonging to family *Streptococcacae* were found in gut of 17.65% colonies. Such incidences destroyed the colonies before the end of July every year.

INTRODUCTION AND IMPORTANCE

Pollination is one of the most important ecological processes on the planet. Among pollinators, bumble bee has gained importance as an efficient pollinator of many commercial crops grown under open field and poly-houses (Chauhan, 2011). These belongs to order Hymenoptera, tribe Bombini, family Apidae and

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genus Bombus. In many countries viz., New-zealand, Holland, Japan, Australia,U.K and U.S.A. bumble bees are being reared commercially. In India, attempts are being made for the domestication of bumble bee, Bombus haemorrhoidalis from a long time but targeted rearing success has not been achieved till now (Kashyap, 2008; Chauhan, 2011 and Rana et al. 2011). During the month of June-July, the developing colonies are attacked by various pests and diseases leading to the cent per cent losses within a month period which is a very huge constraint in bumble bee rearing. Keeping in view the immense importance of pests and diseases in the successful rearing of bumble bees, present studies during 2010-2012 were conducted on this problem for the cyclic domiciliation and commercialization of bombiculture in our country.

MATERIALS AND METHODS

With the onset of spring, thirty four fecundated queens of bumble bee, B. haemorrhoidalis were collected in the early morning and evening, while the queens were foraging for pollen and nectar from various wild, medicinal, vegetable and ornamental plants around Nauni (1256m above mean sea level) and Solan (1276m above mean sea level) area of Himachal Pradesh. Queens were collected with the help of insect collecting nylon net. The queens were brought to the laboratory in plastic vials having perforated lids. These were put in the wooden domiciles and kept in controlled conditions in the incubator at 26±1°C temperature and 65-70% relative humidity. The bumble bee queens were fed with 50% sucrose solution and honey bee collected corbicular pollen. The quantity of sucrose solution fed was 2-3 ml (thrice a week) while 5g of pollen (once a week) was given to the colony. The sucrose solution was replaced every third day while the pollen was replaced once in a week. Feeding was given in lids (iron) of bottle, plastic lids and small petriplates of glass. The quantity of pollen and sucrose was increased with the increasing food demand in growing colony. The time taken by the bumble bee queens for wax secretion from the date of capturing was recorded along with the time required for the emergence of workers from the date of wax secretion in the bumble bee colony. Incidence of pests and diseases during the development period was also recorded. Dead workers and queens from the developing colonies were marked and dissected on the same day of their death. Microscopy of dead bees was done for the identification and to study the cause and causal organism of their death.

RESULTS

In the present studies it was found that the colony initiation took 5-6 days from the date of capturing of bumble bee queens. Eggs hatched in 2.6 days (mean) after laying and the larval period recorded is 17.2 days (mean) while the average pupal stage remained for 8.6 days (Fig. 1). The average total period from egg to adult is 28.4 days (Table 1).

Table 1. Development period of bumble bee, *B. haemorrhoidalis* (in days)

S.No.	Egg	Larval	Pupal	Total
1.	2	17	9	28
2.	3	15	10	28
3.	3	16	8	27
4.	2	19	7	28
5.	3	19	9	31
Mean	2.6	17.2	8.6	28.4

The observation on various pests in the dissected bumble bees revealed the presence of conopid flies, mites, beetles and moths. The colonies were also found to be affected with *Nosema* sp. (Table 2).

Table 2. Observed Pests and Diseases of bumble bees

S.No.	Pests	Diseases
1.	Nematode (Sphaerulariidae)	*Nosema* spp.
2.	Mites	
3.	Moths	
4.	Conopid Flies	

17.65 % of the dissected bumble bee queens were infested with large number of thread shaped juveniles and small round eggs of nematode, *Sphareularia* spp. (Sphaerulariidae) (Fig.2) which were found from the posterior part of the gut that causes destruction of reproductive and digestive system leading to cessation of egg laying and ultimately death of queens. Conopid flies (Fig.3) were present in abdomen of 20.58% dissected bumble bee queens.

The larvae of conopid flies were found as feeding on the systems present in the abdomen causing mortality in queens and infected workers. In addition to these, small oval shaped reddish brown mites were also located on the abdomen (scattered) and legs (clustered on femur) of 11.76% queens which caused death

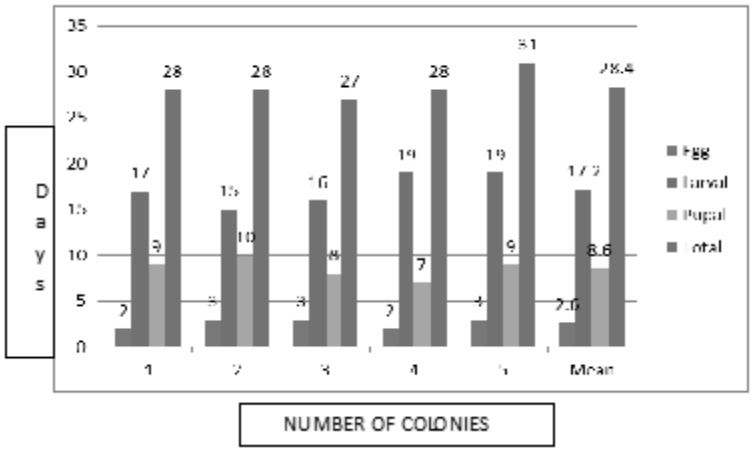

Fig. 1 Development period of bumble bee, *B. haemorrhoidalis* from egg to adult

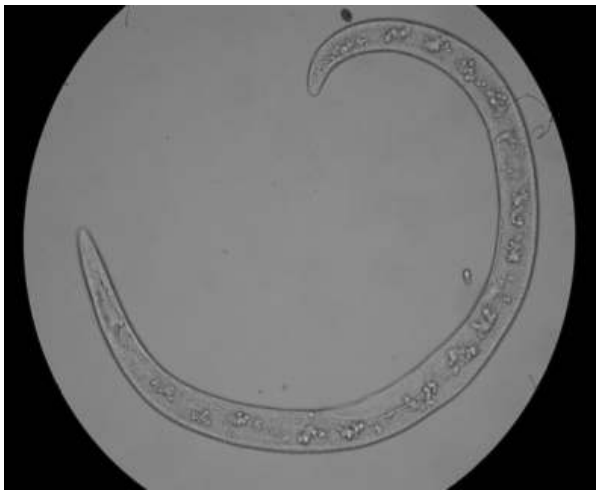

Fig. 2. *Sphreularia* spp.

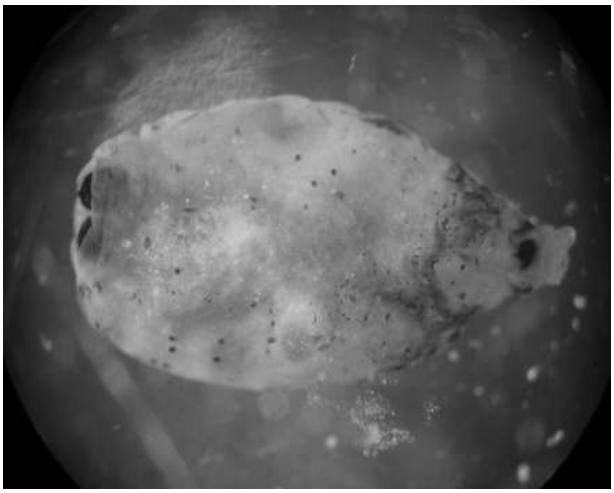

Fig.3 Larva of Conopid fly

Fig. 4a Mites attached on queen leg

Fig. 4a Enlarged mite

Fig. 5 Moth from bumble bee colony

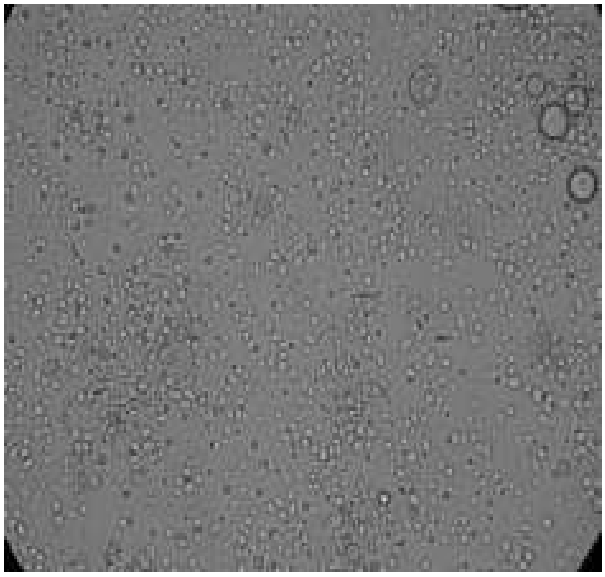

Fig. 6 Nosema spores

Table 3. Per cent incidence of different pests and diseases on bumble bees

S.No.	Pest/ Disease	Per cent infestation	Number of bumble bee colonies infested
1.	Nematode (*Sphaerularia* sp.)	17.65	6
2.	Conopid Fly (Conopidae)	20.58	7
3.	Mites	11.76	4
4.	Moths	8.83	3
5.	Nosema	14.70	5
6.	Unaffected	26.48	-

in 3-4 days after capturing, cause hindering in the initiation of the colonies (Fig.4a, 4b). The small brownish grey coloured moths (Fig. 5) feeding on the wax and pollen also caused losses to the 8.83% developing colonies of bumble bees. Sometimes these were also observed feeding on the larvae of bumble bees. The only disease reported from 14.70% of bumble bee queens was found to be caused by the presence of numerous spores of *Nosema* spp. which were present in the mid gut causing infection and finally their death (Table 3 & Fig. 6).

DISCUSSION

Bumble bee colony initiation took about 5-6 days after confinement and the average total period from egg to adult was found to be 28.4 days which are in the confirmation with the results of Kashyap (2008) who found that bumble bee queens laid wax after 4-6 days after confinement and emergence of workers after wax secretion takes about 26.6 days. From the present studies it was found that bumble bees are susceptible to various pests and diseases such as conopid flies, mites, moths, beetles, nematodes and nosema which are close to the observations of Hempel (1998). He inferred bumble bees are host to a variety of parasitic organisms such as entomopathogenic fungi, mites, nematodes, parasitoids, protozoa, and viruses that may adversely affect their survival and reproductive success. Poinar and Laan (1972) found a nematode Sphaerularia bombi Dufour, which effectively sterilizes hibernating queens. Similar results were found which shows the presence of nematodes, Sphaerularia spp. in the posterior gut of dissected bumble bee queens. Larva or pupa of some parasites in the abdomen of about 20% bumble bee queens were observed and identified as conopid fly (Rana et al., 2011) which is close to the observations of the present studies where the 20.58% queens were infested with conopid flies. Small brownish colored mites were noticed on the legs and abdomen of bumble bee queens which is in confirmation with the observations of Otterstatter and

Whidden (2004) they found that bumble bees containing mites had significantly reduced life spans in the laboratory. Hobbs (1967) observed Pyralid moths feeding on nesting material and small larvae of bumble bees which resulted in colony losses which is close to the observations of some small moths feeding on wax, pollen and larvae of bumble bees during the present studies. Numerous spores of Nosema spp. were found from the mid gut of bumble bees which is in close confirmation with the results of Laarson (2007). He found Nosema bombi in the mid gut fat cells of bumble bee queens.

CONCLUSION

Bumble bees are emerging as an important pollinator, so efforts should be made to know-how technically about rearing and their management. Pest and disease diagnosis is one of the most important part for the successful domestication of this valueable native pollinator. Different pests and diseases cause a huge damage to rearing bumble bee colonies so needs to be controlled. These studies provided a base for carrying the further research on the problems related with bumble bee rearing or the commercialization of Bombiculture industry in our country.

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REFERENCES

Chauhan, A. 2011. *Refinement of bumble bee rearing technology and its use in cucumber pollination.* M.Sc. Thesis, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, India.

Hempel, P. 1998. *Parasites in Social Insects*, Princeton University Press, Princeton.

Hobbs, G.A. 1967. Ecology of species of *Bombus* (Hymenoptera: Apidae) in southern Alberta: VI. Subgenus *Pyrobombus. Can. Ent.* 99:1271-1292.

Kashyap, L. 2008. *Domicilation of bumble bees (Bombus sp.) and to study resource partitioning with honey bees*. M.Sc. Thesis, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, India.

Larsson, R. 2007. Cytological variation and pathogenicity of the bumble bee parasite *Nosema bombi* (Microspora, Nosematidae). *J. Inverte. Patho.* 94 : 1–11.

Otterstatter, M.C. and L.T. Whidden. 2004. Patterns of parasitism by tracheal mites (*Locustacarus buchneri*) in natural bumble bee populations. *Apid.* 35 : 351-357.

Poinar, G.O. and Laan, V. 1972. Morphology and life history of *Sphaerularia bombi*. *Nemat*. 18 : 239-252.

Rana, K., Rana, B.S., Sharma, H.K. and Katna, S. 2011. Hindrance in rearing of bumble bee, *Bombus haemorrhoidalis* (Smith). *Trnds. Biosci*. 4 (1) :51-52.