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Seasonal variation of *Vespa auraria* S. and *Vespa mandarinia* S. (Hymenoptera: Vespidae) attacking *Apis mellifera* L. colonies in district Kangra of Western Himalayas, Himachal Pradesh (India)

VK Mattu and Ishu Sharma

Abstract
The present study was undertaken to study the seasonal variation of predatory wasps, *Vespa auraria* and *Vespa mandarinia* attacking European honeybee, *Apis mellifera* during May 2014 to April 2015. The study revealed that *V. auraria* and *V. mandarinia* caused heavy mortality to honeybees during floral dearth period when colony strength was low due to reduced worker bee population. The population of *V. auraria* was maximum in month of September (21.92 percent) and minimum in month of January (0.82 percent). Peak predatory activity of *V. mandarinia* was in month of October (26.7 percent) and minimum in month of July (8.9 percent) than other months of the year.

Keywords: *Vespa auraria, Vespa mandarinia*, *Apis mellifera*

1. Introduction
Honeybees (Hymenoptera: Apidae) are highly social and cosmopolitan insects inhabiting a broad geographic range. During 1960s exotic European honeybee species, *A. mellifera* was successfully introduced in the foot hills of Himachal Pradesh and agricultural plains of Punjab [9]. A honeybee colony is a vast resource of carbohydrates (honey) and protein substances (pollen, larvae and adults), making it vulnerable to a large number of potential vertebrate and invertebrate pests and predators [5, 2]. Many species of wasps (Hymenoptera: Vespidae) are important threat to honeybees. The wasps attack honeybees both in the field and at the entrance of the colony for protein rich food to larvae and carbohydrate rich food to adult wasps. Wasp hovers near the hive entrance and catch the forager bees, bites off the head and the abdomen of the adult bees and flies back to its nest with thorax, which it uses for feeding larvae [4]. Keeping in view, present studies on the seasonal variation were undertaken to find out the population dynamics of predatory wasps, *V. auraria* and *V. mandarinia* and its impact on honeybee colony development.

2. Materials and Methods
The present study was conducted in Kangra District, Himachal Pradesh. It is mainly a hilly place situated in Western Himalayas between 31°2 to 32°5 N and 75° to 77°45 E. For experimentation *A. mellifera* colonies were selected in Palampur (1287m), District Kangra, Himachal Pradesh. The studies were conducted on seasonal variation of predatory wasps *Vespa auraria* and *Vespa mandarinia* from May 2014 to April 2015. For these studies, annual cycle was divided into summer (May-June), rainy (July-August), autumn (September-November), winter (December-January), spring and early summer (February-April) seasons. Monthly fluctuations were recorded in the activity of *Vespa auraria* and *Vespa mandarinia* wasps attacking *A. mellifera* colonies. These counts were made on all the experimental colonies at regular fortnightly intervals from morning to evening. According to this method, wasp attack was taken as 100 percent and from this data, monthly variations were calculated. Such observations were taken twice a month throughout the year. Results were expressed as a percentage of wasps attacking the honeybee colonies [6].

2.1 Statistical analysis of data
Statistical deviation was calculated by

$$\sigma = \sqrt{\frac{\sum x^2}{N}}$$

Where σ = Symbol for standard deviation.
N = Number of observations.

3. Results and Discussion
Studies on seasonal variation of two wasp species i.e *Vespa auraria* and *Vespa mandarinia* attacking European honeybee, *Apis mellifera* have been summarized as follows:

3.1. Summer Season (May-June)
Number of *V. auraria* was more in the month of June (24.75±0.53) as compared to May (15.80±0.34). The wasp attack was 4.05 percent in May and 6.35 percent in June. However, no population of *V. mandarinia* was observed during the months of May and June (Table 1; Fig. 1).

3.1.2 Rainy Season (July-August)
Population of *V. auraria* was more in August (59.60±0.39) than July (26.80±0.29). In July and August percent wasp attack on *A. mellifera* was 6.87 percent and 15.3 percent respectively (Table 1; Fig. 1).
The attack of *V. mandarinia* was noticed first time in July. The population of *V. mandarinia* was higher in the month of August (43.20±0.65) than July (23.5±0.42). The percent wasp attack was 8.9 percent in July and 16.5 percent in August (Table 1; Fig. 2).

3.1.3 Autumn Season (September-November)
In autumn season wasp reached peak population. The mean population intensity of *V. auraria* was more in September (85.40±0.84) than October (72.70±1.34) and November (56.80±0.97). The percent attack was 21.92 percent in September, 18.6 percent in October and 14.6 percent in November (Table 1; Fig. 1).
The maximum population of *V. mandarinia* was noticed in the month of October (69.75±0.64) as compared to September (56.72±0.30) and November (43.59±0.85). The attack was 21.7 percent in month of September, 26.7 percent in October and 16.69 percent in November (Table 1; Fig. 2).

3.1.4 Winter Season (December-January)
Data revealed more population of *V. auraria* in December (28.50±0.32) than January 3.20±0.16. The percent population of *V. auraria* was 7.32 percent in December and 0.82 percent in January (Table 1; Fig. 1).
The population of *V. mandarinia* in the month of December was (24.38±0.35) and percent wasp attack was 9.33 percent. No attack was observed in January (Table 1; Fig. 2).

3.1.5 Spring and Early Summer Season (February-April)
Mean population of *V. auraria* was more in month of April (11.75±0.21) than March (4.25±0.23). However, no attack of *V. auraria* was observed in month of February. The percent wasp attack was 1.09 percent in March and 3.01 percent in April (Table 1; Fig. 1).
V. mandarinia attack was not observed during the month of January and February in
A. mellifera colonies (Table 1; Fig. 2).
The study revealed that *V. auraria* attacked *A. mellifera* throughout the year. Population of *V. auraria* was maximum in month of September (21.92 percent) and minimum in month of January (0.82 percent). However, *V. mandarinia* attacked *A. mellifera* form July to December. The maximum population of *V. mandarinia* was in month of October (26.7 percent) and minimum in month of July (8.9 percent) than other months of the year. The attack caused heavy mortality to bees in September and October because of reduced worker bee population and low honeybee colony strength due to floral dearth period. Present findings are supported by [1] who reported peak predatory activity of wasps (*V. velutina*, *V. cincta*, *V. magnifica*, *V. orientalis* and *V. mandarinia*) in Jammu and Kashmir during July to September which coincided with the floral dearth period [7]. in Nepal observed peak predatory activity of wasps during July to September, whereas, the frequency of incidence was minimum in April/May [3]. in Punjab reported peak invasion of *V. orientalis* on *A. mellifera* during August and September months and peak activity during noon than in morning and the evening, which most often coincided with activity of bees [10]. suggested that reduced worker bees during the dearth period, which coincided with rainy and autumn season provided the favorable conditions for wasp multiplication. Similarly, [8] observed maximum predatory activity of *V. auraria* and *V. mandarinia* during August, September, October and November months of the year in Himachal Pradesh.

Table 1: Seasonal fluctuations in population of *Vespa auraria* and *Vespa mandarinia* attacking *A. mellifera* colonies at Palampur (1287m), Himachal Pradesh.

		2014								2015			
Wasps		**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**	**April**
V. auraria	$\overline{X}$ ±SE	15.80 ±0.34	24.75 ±0.53	26.80 ±0.29	59.60 ±0.39	85.40 ±0.84	72.70 ±1.34	56.80 ±0.97	28.50 ±0.32	3.20 ±0.16	-	4.25 ±0.23	11.75 ±0.21
	%age	4.05*	6.35	6.87	15.3	21.92	18.6	14.6	7.32	0.82	-	1.09	3.01
V. mandarinia	$\overline{X}$ ±SE	-	-	23.5 ±0.42	43.2 ±0.65	56.72 ±0.30	69.75 ±0.64	43.59 ±0.85	24.38 ±0.35	-	-	-	-
	%age	-	-	8.9	16.5	21.7	26.7	16.69	9.33	-	-	-	-

$\overline{X}$ +S.E =Mean ± Standard error about mean
* Figure in parenthesis indicate percentage
Population expressed in term of number of *Vespa* sp./hive/day

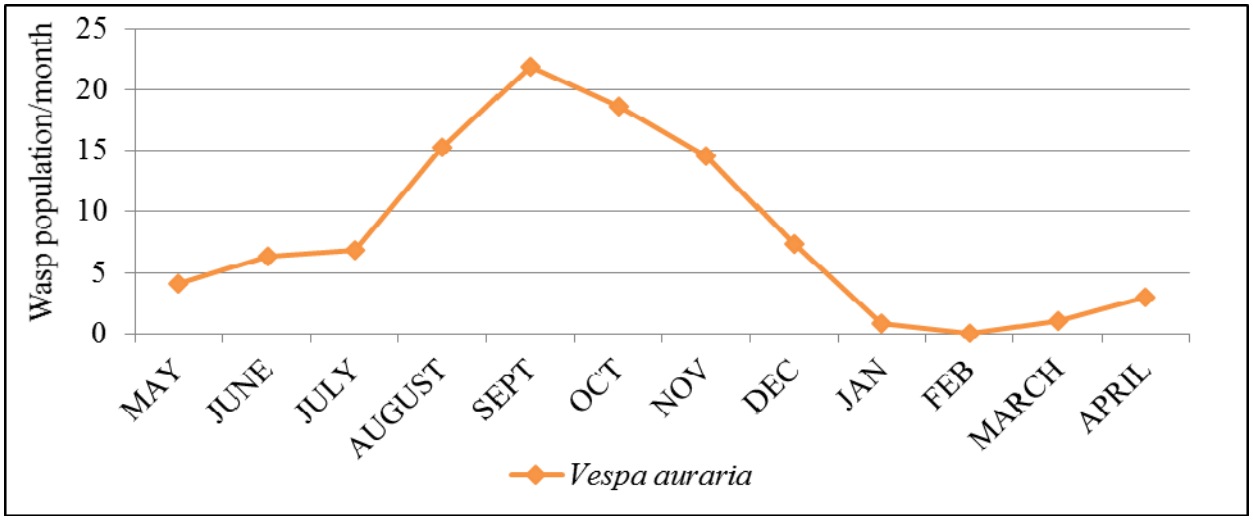

Fig 1: Seasonal fluctuations in population of *V. auraria* attacking *A. mellifera* at Palampur (1287m), Himachal Pradesh

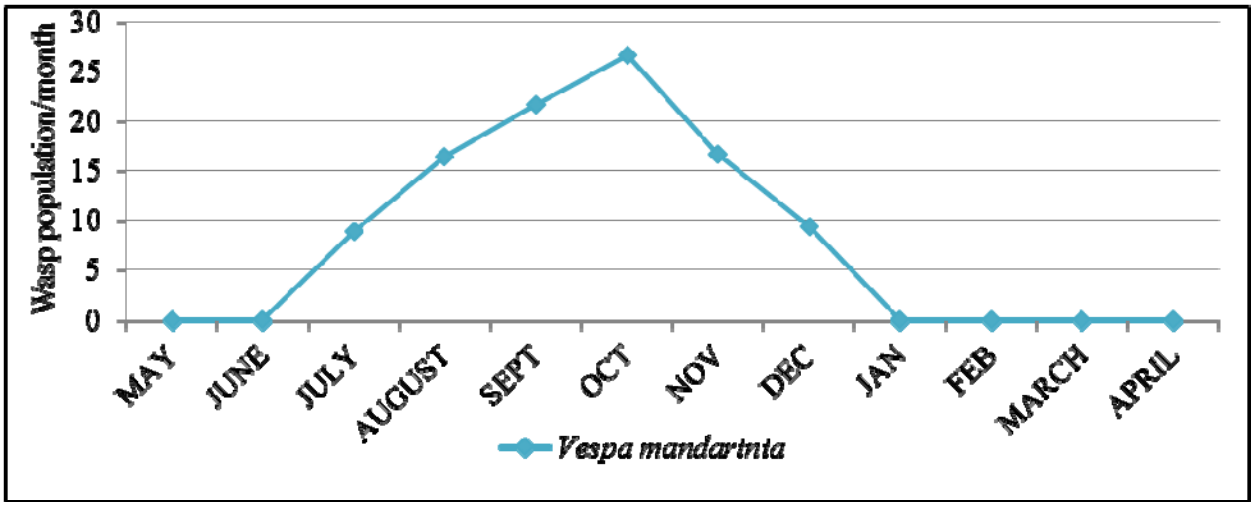

Fig 2: Seasonal fluctuations in population of *V. mandarinia* attacking *A. mellifera* at Palampur (1287m), Himachal Pradesh.

4. Conclusion

V. auraria and *V. mandarinia* attack on *A. mellifera* varied with season but was more during the floral dearth period in District, Kangra (Himachal Pradesh). The seasonal management practices should be adopted like the use of protein baits (meat and fish bait) and special care of bees during dearth period when floral sources are limited.

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6. References

1. Abrol DP and Kakroo SK. Studies on seasonal activity and control of predatory wasps attacking honeybee colonies. Indian bee Journal. 1998; 60(1):15-19.
2. Baracch D, Francese S, Turillazzi S. Beyond the antipredatory defence: Honey bee venom function as a component of social immunity. Toxicon. 2011; 58, 550–557.
3. Chhuneja PK, Singh J, Blossom and Gatoria GS. Population density of *Vespa orientalis* Linnaeus attacking *Apis mellifera* Linnaeus colonies in Punjab. Journal Insect science. 2008; 21(2): 161-167.
4. DeJong D. Insects: Hymenoptera (Ants, Wasps and Bees). In honey bee pests, predators and diseases. ed. R.A. Morse. Ithaca, Cornell University printing press.1980, 138-157.
5. Matsuura M. and Sakagami SF. A bionomic sketch of the giant hornet, *Vespa mandarinia*, a serious pest for Japanese apiculture. Journal of the Faculty of Science. Hokkaido University. 1973; 19, 125–162.
6. Mattu VK and Verma LR. Studies on annual foraging cycle of *Apis cerana indica* F. in Shimla hills of northwest Himalayas. Apidologie. 1985; 16(1):1-18.
7. Ranabhat NB. and Tamrakar AS. Study on seasonal activity of predatory wasps attacking honeybee *Apis cerana* Fab. colonies in Southern Belt of Kaski District, Nepal. Journal of Natural History Museum. 2008; 23:125-128.
8. Sharma V, Mattu VK and Thakur MS. Diversity, distribution and seasonal variations of *Vespa* species in honeybee colonies of Himachal Pradesh. Annual review of Entomology. 2011; 29(2):1-3.
9. Thomas D, Pal N and Rao, SK. Bee management and productivity of Indian honeybees. Apiacta, 2002; 3.
10. Varshneya I, Pandey AK, Mall P and Rathore RRS. Seasonal incidence of predatory wasps in *A. mellifera* colony having different number of frames. Journal of Entomological Research. 2009; 33(1):45-49.