Effects of sudden temperature change on overwintering of honey bee (*Apis mellifera* L.) colonies

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ABSTRACT

Climate is the average weather conditions that happen in the large areas in a very long time. While climate includes the extreme weather events, it defines the character and vegetation of the areas in terms of weather events. Turkey is under the influence of four climate zones such as continental climate, Mediterranean Climate, Marmara Climate and Black Sea Climate. Continental Climate, in terms of rainfall and temperature characteristics, is divided into four subtypes such as Southeastern Anatolia Continental Climate, Eastern Anatolia Continental Climate, Central Anatolia Continental Climate and Thrace Continental Climate. Continental climate, especially above sea level, is seen as much in our Eastern Anatolia Region that has more elevation. This region, that this climate is seen, is faced with the lowest temperature in our country. Mediterranean Climate, that happens with summer are hot and dry and winters are warm and rainy, is seen in both Mediterranean and Aegean Regions. Black Sea Climate is seen in the Black Sea Coast and it is a type of climate that has temperature character showing marine thermal properties. Marmara Climate, also called as transition climate, is seen in the southern part of Marmara Region including North Aegean. The winter is not as warm as Mediterranean Climate and the summer is not as rainy as Black Sea Climate. The winter is not as cold as Continental Climate and the summer is not dry.

Honey bees are poikilothermic creatures. Their body temperature increases and decreases in terms of ambient temperature. Especially, they are affected by temperature that is the environmental factor in the high level. In this sense, they have developed the ability of regulating the temperature and similar environmental conditions. However, it is required to produce extra energy in order to regulate it when the difference of the temperature increases and decreases, so the wear can be occurred. The comfort zone for the bee is 26ºC in terms of temperature factor. Any change or deviation from this level can be required to use extra energy and so, economic losses will be occurred (Güler, 2006).

Honey bee is in the metabolic activities that are adequate for ensuring the lowest ambient temperature which is necessary for them to live in the hive during the winter. Bee family spends the winter by clustering as spherical depending on the environmental conditions and the structure and behavior of this cluster, also called as winter cluster, are associated with ambient temperature. Honey bee forms a social structure in the hive by creating cluster with a reduction of ambient temperature (Fıratlı, 1993). The winter cluster in honey bees starts below 14 ºC and the outside temperature of the cluster is between 6-8 ºC. While the ambient temperature is 10-14 ºC, honey bee forms small group in the hive. When the hive temperature falls below 10 ºC, bees hold each other on honey comb as a circle cluster. Young worker bees and queen bees are in the centre of the cluster usually (Dietz, 1984; Genç, 1993). Relaxation and dissolution can occur because of the rapid difference of the temperature. The bee can form a again cluster by choosing a place without enough food as a result of cold weather. The cluster can starve because it cannot provide necessary temperature because of the contact losses with the food (Yorgancıoğlu, 2001). In addition, the

colony's honey stock will affect by the rapid difference of the temperature in a negative way. Honey consumption will increase because of the continuous degradation of the cluster. This situation can lead to the death of a strong colony and it is obvious pull down the performance of the colony in the nectar flow period.
In this study, we have examined the temperature data belong to November, December, January and February months in 2011, 2012 and 2013 in the cities such as Ordu, Ankara, Mersin and Ardahan that are located in different climate zones in our country. According to the data from General Directorate of Meteorology, temperature differences have been calculated and monthly temperature distribution have been plotted on the basis of the highest and lowest daily temperature values.
The average of the temperature belong to Ordu, Mersin, Ankara and Ardahan in the last two wintering period is respectively 9,0°C; 12,7°C; 3,4°C and -6,7°C. Significant increase was observed when the average temperature data of 2012-2013 winter period had compared with the 2011-2012 winter period data. According to the previous wintering period, temperature increase was observed as 3,6°C in Ordu, 2,6°C in Mersin, 4,7°C in Ankara and 3,4°C in Ardahan. When the temperature difference between the specified dates have been examined the first city is Ardahan with 10,4°C and it is followed by Ankara with 7,9°C, Mersin with 7,2°C and Ordu with 6,1°C. Threshold degree flight activity of honey bees is 14°C and the number of days that repeat higher temperatures during the winter period are respectively 85, 184, 29, 0 for Ordu, Mersin, Ankara and Ardahan. Mersin has minimum level of forming a cluster in terms of geographic location. But, there is an opposite case for Ardahan. The winter's temperature in the level cannot direct the flight activity of honey bee. Ardahan is one of the provinces that has the lowest temperature can be shown between the provinces will cause a problem in winter. Dissolution of the cluster can be seen in Ordu which has Black Sea Climate. Dissolution of the cluster in the wintering period is an undesirable situation. Ankara hasn't got as low temperature as Ardahan and it is the second province that has the temperature value that distorts the cluster.
Population loss in the wintering period is one of the most debated issues. Because, we don't have adequate information about the temperature increases lack of nutrition, housing conditions. We can say that wintering period is the most sensitive stage in the phases of the apiculture and it is required to increase the number of researches about the wintering period taking into consideration the sharp changes.

Key words: Honey bee (*Apis mellifera* L.), Climate zones, Wintering