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INFLUENCE OF WEATHER CONDITIONS ON HONEY BEE VISITS (*Apis mellifera carnica*) DURING SUNFLOWER (*Helianthus annuus* L.) BLOOMING PERIOD

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Original scientific paper

SUMMARY

The objective of the investigation was to determine influence of weather conditions on activity of honey bees during blooming time of six sunflower hybrids. The investigation was carried out in 2002 growing season at Kneževi Vinogradi located in Baranja county, north-eastern edge of Croatia. Honey bees communities were moved to the field trial site inside Langstroth-Rooth's bee-hives. Honey bees visiting sunflower head inflorescence was measured at 100, 200, and 300 meters by counting honey bees four times a day (9.00 am, 11.00 am, 1.00 pm, and 5.00 pm). The influence of weather conditions was analysed by Spearman correlation coefficient. Results of the investigation show significant differences regarding honey-bee visit to the head inflorescences in six hybrids, as well as significant influence of air temperature, humidity, precipitation, minimum and maximum air temperature, as well as wind strength.

Key-words: honey bee, sunflower, visit, weather conditions

INTRODUCTION

Sunflower (*Helianthus annuus* L.) belongs to typical alogamic (cross pollinated) entomophilic plants, which require pollinator's effect high quality fertilisation. In general, the role of pollinators has been well known since long ago but it has been quite neglected until recently. The importance of pollination within the agricultural ecosystems, based on monoculture, crop rotation, and pesticide application, has been neglected, so the pollinators have decreased or even disappeared over time.

These are some of the reasons for the experiments, such as here presented, to deal with the activities of honey bees in pollination of agricultural crops such as sunflower. Honey bees (*Apis mellifera carnica*), because of their high numbers, intensive daily activity, as well as their body structure assure pollen transportation from one sunflower head inflorescence to another. This provides for high quality pollination of the tube shaped sunflower flowers (Free, 1993). Cimu (1960) noticed that sunflower hybrids being pollinated by honey bees produce up to 40% higher grain yield compared with those which had not been pollinated by honey bees. Other authors (Kevan, 2001; Kumar et al., 2002, 2003; Pidek and Pohorecka, 2004) also confirmed such results and also emphasised the importance of introduction of honey bees pollination as a regular technologic measure in the cultivation of sunflowers. Grain yield, besides oil content, is the most important component of oil yield (Mijić et al., 2006.) making this trait highly attractive to farmers involved in the production of commercial sunflower. Numerous investigations showed that there was a difference among sunflower hybrids regarding their pollination by honey bees (Miklič, 1992, Singh and Singh, 1999) caused by differences in activity of bees in various weather conditions (Miklič, 1996; deGrandi-Hoffman et al., 2000). The objective of this investigation was to determine the influence of weather conditions on honey bee visit to sunflower head inflorescences.

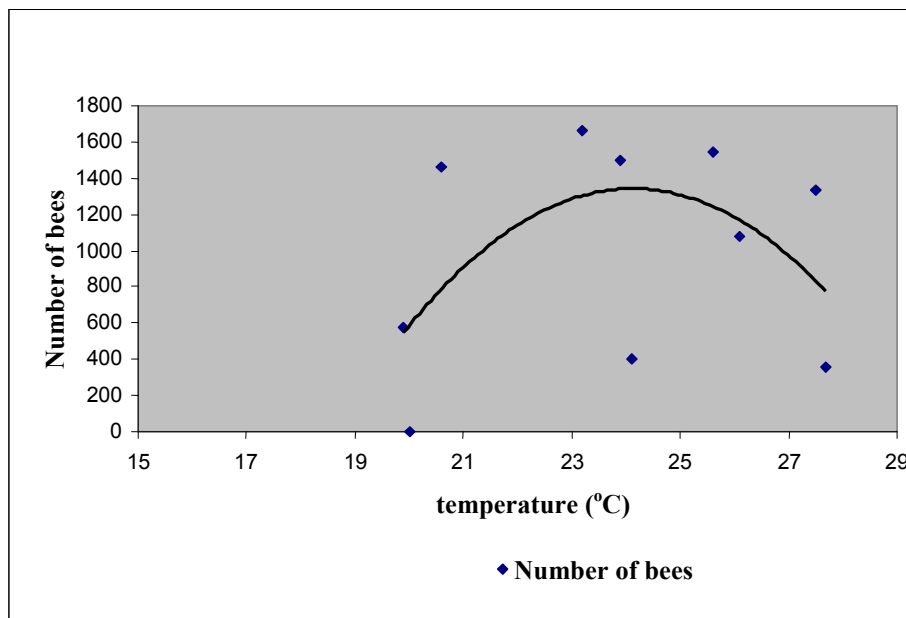
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MATERIAL AND METHODS

The investigation was carried out during 2002 growing season at Kneževi Vinogradi location, Baranja County (northern-east part of Croatia). This area is characterised by a moderate continental climate with semi-arid spots. Hydro meteorological data obtained from Brestovac-Belje station were used for interpretation of meteorological conditions. Experimental material consisted of six sunflower hybrids (Util, Lucil, PR64A42, PR63A90, Fakir, and Orion) widely used in Croatian agricultural production. Honey bees communities were transported to the fields inside Langstroth-Rooth bee hives. Their strength was appropriate to the corresponding strength for successful pollination (Free 1993). Honey bees' visiting sunflower inflorescences were assessed at 100, 200, and 300 meters, by counting the individual bees present four times a day (9.00 Am., 11.00 Am., 1.00 pm., and 5.00 pm.). The weather conditions influence was measured by Spearman correlation coefficient.

RESULTS AND DISCUSSION

Total daily visit of the bees depended on weather conditions. The most frequent visit was noticed after rainy days occurred on the 4th and 7th of July 2002. During those days the daily average air temperature was between 20 and 25 degrees centigrade whereas humidity varied between 65 and 75% (Figure 1). This is in accordance with the investigations performed by Miklič (1996), Sihag and Khatkar (1999), Patil and Viraktamath (2001), Nargis et al. (2001), Mordago et al. (2002), Kumar et al. (2002). These authors observed a decreased daily activity of honey bees on the days characterized by maximum temperature and highest humidity. Different authors noticed the most intensive honey bee activity during different weather conditions, depending upon particular investigation site and its weather conditions. Kumar et al. (2002) pointed out agro-ecological data for Punjab county in India showing the most intensive bee activity at 18.3 degrees centigrade and 60% humidity. Miklič (1996) presents data obtained at Rimski Šančevi site near Novi Sad, Serbia, under weather conditions similar to ours. Author observed the most intensive bee activity at 20 to 28 degrees centigrade and humidity at 40 to 50%. The results appeared to be lower than those obtained in this investigation (65-75%).



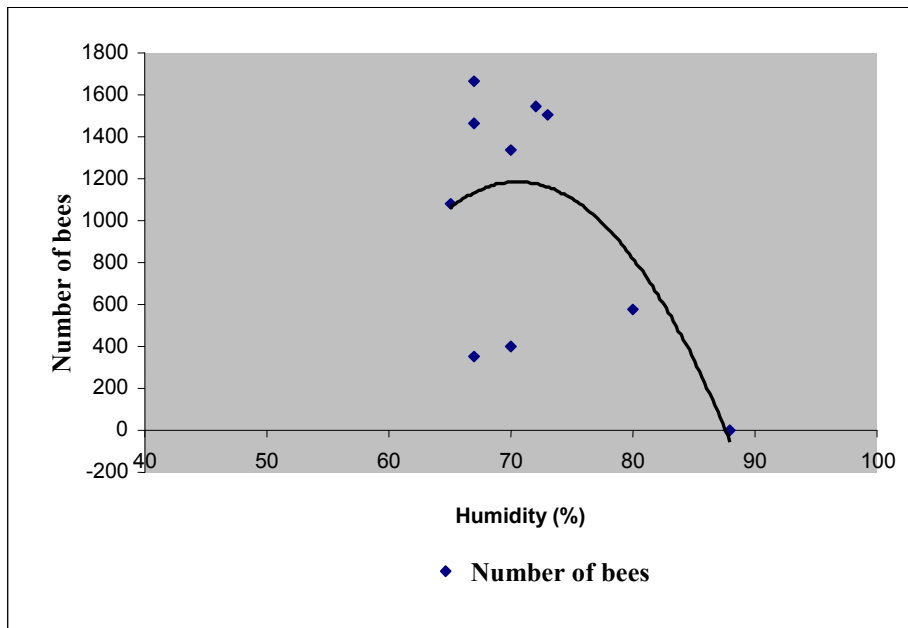


Figure 1. Influence of air temperature and humidity on honey bees visit of sunflower inflorescences during flowering time

The lowest visit was estimated in the days interrupted by localized rainfalls (4th and 8th July 2002). The total absence of honey bees was noticed on July 7th 2002 because of all-day rain (Figure 2). Honey bees do not exit bee hives during rainy days (Miklić, 1996).

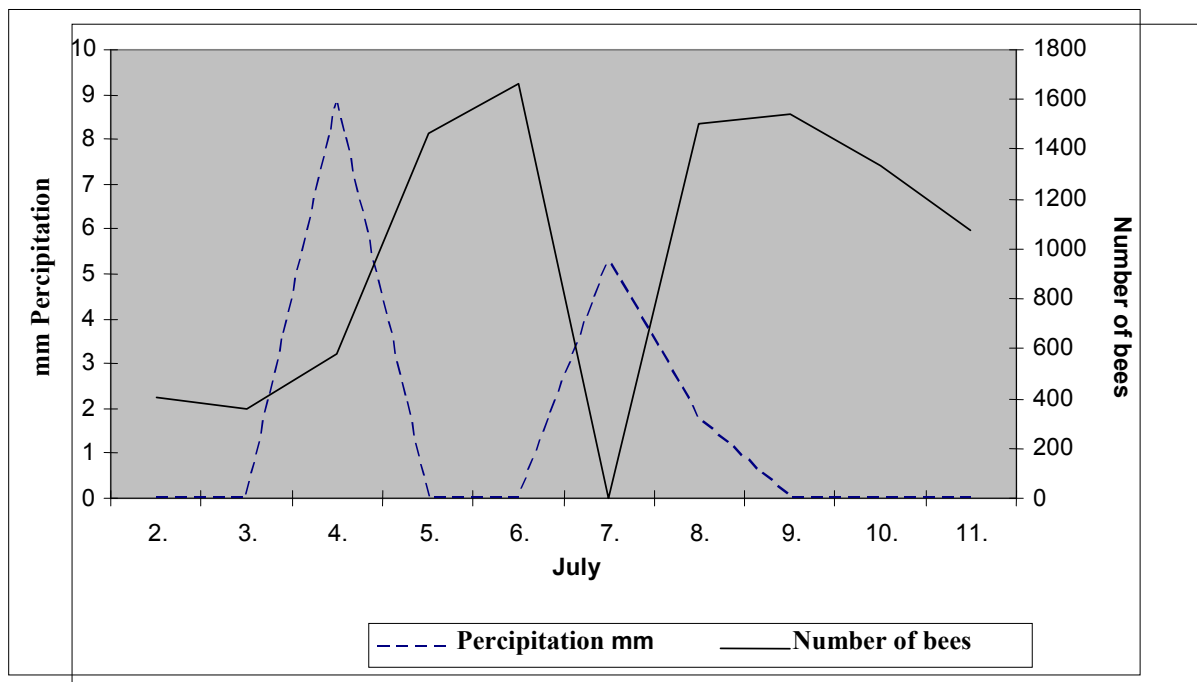


Figure 2. Precipitation influence of honey bees visit on sunflower hybrids

Relationship between weather conditions and honey bee visit was analyzed by Spearman coefficient. Table 1 shows no significant correlation between honey bee visits and weather indicators. However, positive correlation has been noticed between average and maximum daily temperature and the visits, whereas higher humidity, heavy precipitation, stronger wind and lower daily temperature had negative impact on sunflower inflorescence visits. Jocić et.al. (2000) made observations quite similar to this investigation, i.e. the most intensive honey bee activities were noticed at daily temperature 20 to 28

degrees centigrade. Rain had strong negative impact on honey bee activity and pollination. Authors also pointed out negative influence of minimum daily temperature on bee activity during the day if lower than 10 degrees centigrade. The authors also suggest that the ideal ratio between minimum and maximum daily temperature would be at 10 to 30 degrees centigrade. This has also been approved by this investigation.

Table 1. The relationship between weather conditions and honey bees visit of sunflower inflorescences during flowering time

<i>Weather indicator</i>	<i>Spearman's correlation coefficient</i>	
Air temperature	0.420	NS
Humidity	-0.252	NS
Precipitation	-0.321	NS
Maximum air temperature	0.030	NS
Minimum air temperature	-0.085	NS
Max/min air temp.(DTR)	-0.030	NS
Wind	-0.210	NS
Wind strength	-0.114	NS

NS – non significant

CONCLUSION

Based on the above results it can be concluded that the weather conditions have evident influence on sunflower inflorescence visit by honey bees. The most frequent visits were estimated at 20 to 25 degrees centigrade and humidity at 65-75%. Precipitation had negative impact on honey bees visit. Statistical analysis showed strong positive correlation between average as well as maximum daily temperature and the honey bee's visits. Higher humidity, heavy rain fall, wind, and low temperature had negative influence on sunflower inflorescences visits.

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