INFLUENCE OF THE CLIMATIC FACTORS ON THE MELLIFEROUS CHARACTERISTICS OF THE SUNFLOWER HYBRIDS

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In the present paper, there is presented the influence of water and temperature factors on the melliferous characteristics on different sunflower hybrids, respectively on nectar secretion of flowers, nectar concentration in sugar, glucidic index (the produce of nectar secretion and nectar concentration in sugar), honey yield, and period and duration of the flowering process. In view to establish the influence of the climatic factors on the melliferous characteristics on the sunflower hybrids, there were used the experimental data of researches carried out along the time by the specialists from Faculty of Agriculture - University of Agronomical Sciences and Veterinary Medicine of Bucharest and Melliferous Resources Laboratory - Apiculture Research and Development Institute of Bucharest. Also, there are presented the data obtained within some field experiments with sunflower hybrids carried out in the period 2006-2007 by specialist of both institutions presented above.

***Keywords**: Sunflower, climate, factors, melliferous, characteristics.*

The surfaces cultivated with sunflower in Romania have registered an increased trend after 90's years, this being one of the crops which kept a great interest from the farmers. In the same time with this great interest from the farmers, the beekeepers are also very interested about sunflower, especially about the specific melliferous characteristics of the hybrids. That is due to the fact that in Romania, the sunflower represents the most important melliferous plant among the field crops even by the period and duration of flowering or by the large number of flowers and nectar secretion. But, the melliferous potential of the sunflower hybrids is depending on the climatic factors, this been observed by the beekeepers in the form of a great variation in time and space of the honey yield for the same sunflower hybrids. Among the climatic factors, the water (rainfall) and temperature are the most important, these having a significant influence on the melliferous potential of the sunflower hybrids, as well as on the moment and duration of the flowering process.

MATERIAL AND METHODS

In view to identify and quantify the influence of the climatic factors on the melliferous characteristics of the sunflower hybrids, data regarding the melliferous potential at the sunflower hybrids cultivated in Romania were collected, analyzed and interpreted. In this respect, there were used the database belonging to the Melliferous Resources Laboratory – Apiculture Research and Development Institute of Bucharest and the experimental data obtained during the time by the researchers from Faculty of Agriculture, University of Agronomic Sciences and Veterinary Medicine of Bucharest in collaboration with the researchers from Apiculture Research and Development Institute of Bucharest. Also, the climatic data starting from 1960 were collected, analyzed and correlated with the melliferous data of the sunflower varieties and hybrids.

Also, researches were carried out in field experiments in the years 2006 and 2007, on a reddish preluvosoil located 15 km northeastern faraway from Bucharest. The field experiments were located within the experimental farm of the Faculty of Agriculture – University of Agronomical Sciences and Veterinary Medicine of Bucharest. These field experiments were part of researches carried out within the CEEX research project no 106/2005.

Researches in field experiments were carried out on 23 sunflower hybrids, respectively: Rocky, Kasol, Lindor, Masai, Mateol, Podium, Saxo, Sunko, Fly, Rigasol, RigasolOR, Fleuret OR, Arena, Melody, NKArmoni, Alexandra, NK Dolbi, NK Ferti, Opera PR, Sanay, Delfi, Jazzy, Brio.

In view to calculate the honey yield, the nectar secretion was determined using the capillaries method, and by means of a refract-meter the nectar concentration in sugar was determined. Also, the climatic data were registered by the help of an automatic weather station.

In 2007, four sunflower hybrids (Fleoret OR, Melodi, Sunko and Arena) were studied at different sowing periods, respectively: 1st period – 27th of March; 2nd period – 6th of April; 3rd period – 18th of April; 4th Period – 12th of May; 5th Period – 2nd of June. By sowing at different periods it was intended that the flowering period overlap periods with different climatic conditions, so that to be determined the melliferous potential in the studied hybrids over different climatic conditions and to be registered the variation of this potential according to climate conditions.

RESULTS AND DISCUSSIONS

The melliferous potential at the *Helianthus annuus* species has followed an ascending curve over the last decades, been determinate especially by the biological factor, respectively varieties and hybrids cultivated in our country. Thus, in the period 1948-1958, when there where cultivated the varieties Măslinica and Uleioasa, the melliferous potential was of 15-20 kg of honey per hectare. Later, when there where cultivated the varieties Jdanov 8281 and Vniimk 8931, the melliferous potential was about 30 kg of honey per hectare. In the years ’70, when

the Record variety was cultivated on the most sunflower surface, the melliferous potential was about 40 kg of honey per hectare. In the period ‘80 - ’90, when the hybrids where created and cultivated on the most of sunflower surface, the melliferous potential was about 50-60 kg of honey per hectare.

The melliferous potential at sunflower is determined by the biological factor (variety or hybrid) but this is significantly influenced by the climatic conditions, especially by water (rainfall) and temperature factors. Thus, the increase of the melliferous potential due to the increased quality of biological factor (variety or hybrid that is cultivated) was overlapped with an increase of the climatic favorability. The high melliferous potential from the years ’80 was overlapped with the most favorable climatic conditions, respectively rainy years (figure 1) with low temperatures (figure 2). The decreasing tendency registered on rainfall and increasing tendency registered on temperature over the two decades have had a negative influence on the melliferous potential at sunflower, this been observed by the beekeepers in their daily activities through a high variability in space and time of the honey yield.

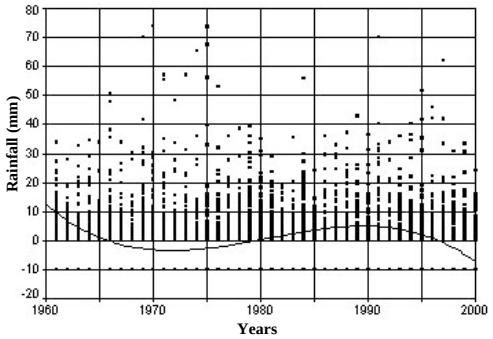

Figure 1. **Variation of the rainfall during the time (mathematical model)**

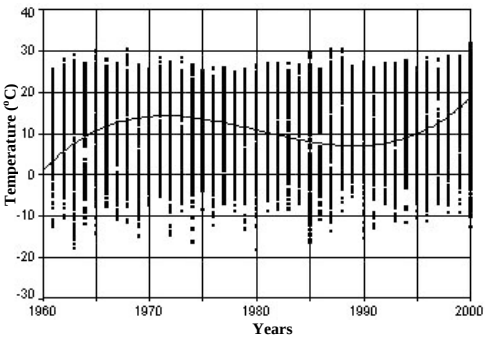

Figure 2. **Variation of the temperature during the time (mathematical model)**

The rainfall represents one of the climatic factors with a significant influence on the nectar secretion and nectar concentration in sugar at sunflower, respectively on the glucidic index which represents the quantity of sugar produced by a flower. By analyzing the melliferous data and the climatic conditions over time, it was observed that rainfall more than 300-400 mm from January to sunflower flowering, and rainfall more than 200-300 mm along the vegetation period of sunflower up to the flowering process, have had a positive influence on the glucidic index, respectively have determined an increased honey yield. Also, the rainfall in the period of sunflower flowering has had a positive influence on the honey yield (figure 3). Of course, whether the flowering process is overlapping a period with lots of rains, the melliferous bees will not collect the nectar because they are clogged to fly, and the high potential honey yield will not be valorized by the bees.

Temperature represents also one of the climatic factors with a significant influence on the nectar secretion and nectar concentration in sugar at sunflower, respectively on the glucidic index. By analyzing the melliferous data and the

climatic conditions over time, it was observed that daily average temperatures less than 19°C for the period 1st of May – 15th of July and less than 20.5°C for the period 1st of June – 15th of July decreased the glucidic index. Also, it was observed that a high temperature during the flowering process has a negative influence on the glucidic index, decreasing the honey yield (figure 3).

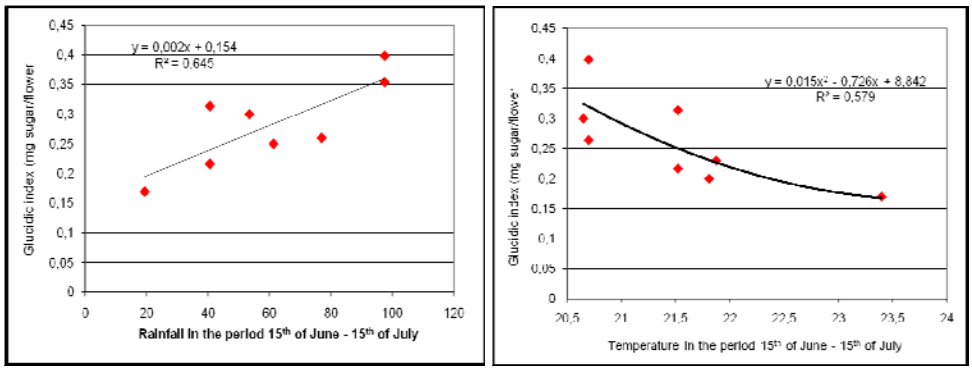

Figure 3. **Influence of the rainfall and temperature on the glucidic index during the flowering process at sunflower hybrid Vniimk 8913 A, in the periode 1963-1978**

The most significant influence on the honey yield, respectively on the glucidic index has the nectar secretion, this been most affected by the climatic conditions (figure 4).

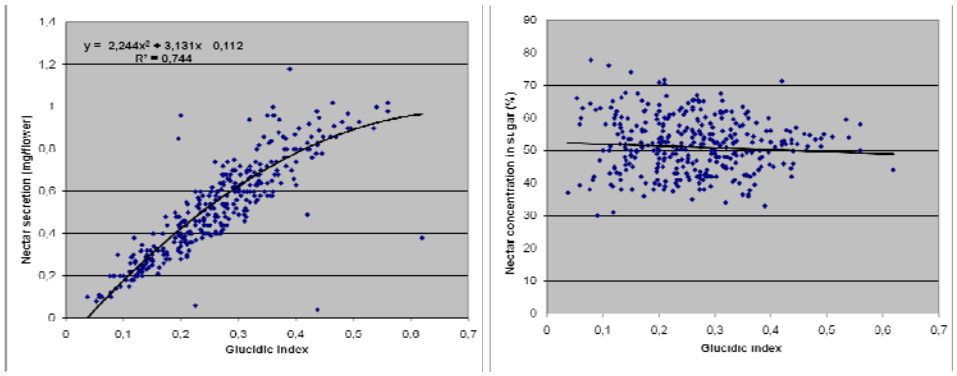

Figure 4. **Correlation between gludicid index and nectar secretion, respectively nectar concentration in sugar at the sunflower hybrids studied in the period 1960-1992**

Between the nectar secretion and nectar concentration in sugar there is a negative correlation, the increasing of one determining the decreasing of the other (figure 5). Both of the melliferous characteristics are influenced by the climatic factors (water and temperature factors), but the most significant influence is registered on nectar secretion.

The years 2006 and 2007 were less favorable for sunflower, from the climatic point of view, for the area where researches with sunflower hybrids were conducted. Whether in 2006, the average temperatures were not much deviated from the multi-annual average, the soil water deficit before flowering affected the growth of the leaves and thus the photosynthetic leaf area. The year 2007 was even less favorable for agricultural crops, including sunflower, from the climate point of view, following the spring and summer drought, as well as the high temperatures during the vegetation period, conditions that had a negative influence on the growth and development of the plants.

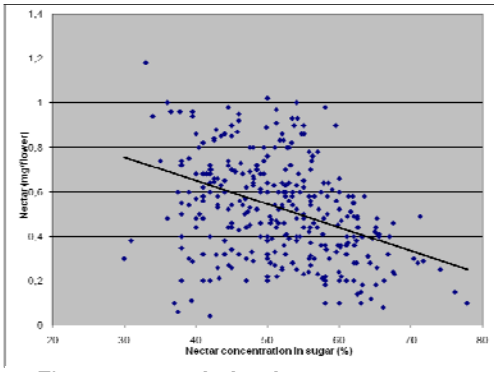

Figure 5. **Correlation between nectar secretion and nectar concentration in sugar at the sunflower hybrids studied in the period 1960-1992**

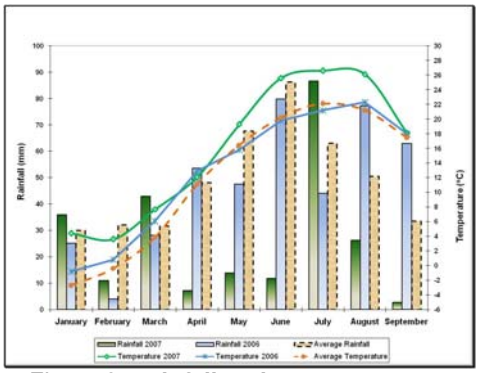

Figure 6. **Rainfall and temperatures in 2006 and 2007**

The climatic conditions from the year 2007, which were worse than the ones from the year 2006, have determined an early flowering time, especially because of the higher temperatures. But, in the same time, especially because of the drought, the moments when 10% of the heads are still in flower and the end of flowering process (no any flowered heads) are comparable in the two experimental years. This is explained by the differences between plants in their development, starting with the plant emergency and up to the flowering process, which determined a lagging of the flowering process, within the crop (table 1).

The occurrence date for the first heads flowering in the studied sunflower hybrids varied between 24th and 28th of June, in 2006, and between 18th and 23th of June, in 2007.

The beginning of the flowering process, i.e. when 10% of the heads have flowered in the whole crop, was recorded between 27th of June and 1st of July, in 2006, and between 20th and 26th of June, in 2007 (table 1).

From the melliferous point of view, the most interesting period is that between the moment when 10% of the sunflower heads have flowered and the time when only 10% sunflower heads are still in flower, as this period marks the actual intense nectar gathering by the melliferous bees. This period varied between 14 and 18 days, in 2006, and between 13 and 21 days, in 2007 (table 1).

Table 1

Data regarding the flowering process at an assortment of sunflower hybrids grown in Romania (2006-2007)

Nr. crt.	Sunflower hybrid	First heads flowering		Beginning of flowering process (10% of the heads flowered)		10% of the heads are still in flower		End of flowering process (no any flowered heads)	
		2006	2007	2006	2007	2006	2007	2006	2007
1.	Rocky	28.06	22.06	29.06	24.06	13.07	8.07	19.07	18.07
2.	Kasol	28.06	22.06	29.06	25.06	16.07	8.07	19.07	18.07
3.	Lindor	28.06	20.06	29.06	23.06	16.07	7.07	19.07	14.07
4.	Masai	28.06	22.06	01.07	26.06	17.07	9.07	19.07	18.07
5.	Mateol	26.06	19.06	28.06	24.06	14.07	7.07	18.07	18.07
6.	Podium	28.06	22.06	29.06	25.06	16.07	9.07	19.07	18.07
7.	Saxo	27.06	19.06	29.06	25.06	14.07	9.07	18.07	15.07
8.	Sunko	27.06	21.06	29.06	23.06	16.07	10.07	19.07	18.07
9.	Fly	28.06	21.06	01.07	24.06	16.07	7.07	18.07	18.07
10.	Rigasol	28.06	18.06	29.06	21.06	16.07	6.07	18.07	15.07
11.	RigasolOR	24.06	18.06	28.06	20.06	13.07	5.07	18.07	18.07
12.	Fleuret OR	24.06	18.06	27.06	20.06	12.07	7.07	18.07	18.07
13.	Arena	28.06	22.06	29.06	23.06	12.07	11.07	18.07	16.07
14.	Melody	28.06	22.06	30.06	24.06	15.07	7.07	18.07	18.07
15.	NKArmoni	28.06	23.06	01.07	25.06	18.07	11.07	20.07	19.07
16.	Alexandra	27.06	21.06	29.06	23.06	14.07	8.07	18.07	18.07
17.	NK Dolbi	28.06	22.06	29.06	24.06	14.07	8.07	18.07	18.07
18.	NK Ferti	27.06	22.06	29.06	23.06	14.07	10.07	18.07	18.07
19.	Opera PR	28.06	23.06	29.06	25.06	14.07	11.07	18.07	18.07
20.	Sanay	24.06	21.06	28.06	24.06	15.07	14.07	18.07	20.07
21.	Delfi	28.06	23.06	29.06	24.06	15.07	15.07	19.07	20.07
22.	Jazzy	28.06	22.06	29.06	23.06	15.07	12.07	19.07	19.07
23.	Brio	27.06	23.06	29.06	25.06	15.07	15.07	19.07	19.07
	Limits of variation	*24.06 – 28.06*	*18.06 – 23.06*	*27.06 – 01.07*	*20.06 – 26.06*	*12.07 – 18.07*	*05.07 – 15.07*	*18.07– 20.07*	*14.07 – 20.07*

In the year 2007, the average honey yield was bigger than in the year 2006 (figure 7). Thus, in the year 2006, the average honey yield varied between 6.1 kg/ha (Saxo hybrid) and 16.1 kg (Sunko hybrid), but in 2007, the average honey yield varied between 9.5 kg/ha (Sanay hybrid) and 23.2 kg/ha (Lindor hybrid).

By sowing at different dates the melliferous potential is different according to climatic conditions, but also according to sunflower hybrid (figure 8). The relatively good potential honey yield over the first two sowing periods is partly determined by the soil water reserve accumulated during fall winter rainfall. Yet, the extremely drought period from April, May and June led to a reduced potential honey yield during the third sowing period. July rainfall led to high potential honey yields. Sunflower hybrids respond differently to the action of climate factors in terms of melliferous characteristics. Among the studied hybrids, the Sunko hybrid was noticed for its high melliferous potential in most conditions, except for the most severe in terms of water stress. In exchange, under conditions of water stress, Arena hybrid responded well from the point of view of potential honey yield.

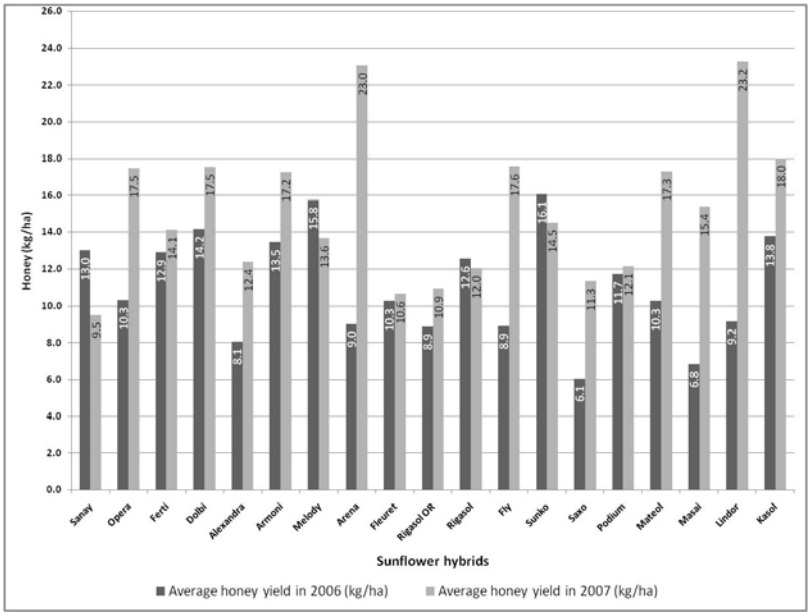

Figure 7. **Average honey yield at an assortment of sunflower hybrids cultivated in Romania, 2006-2007**

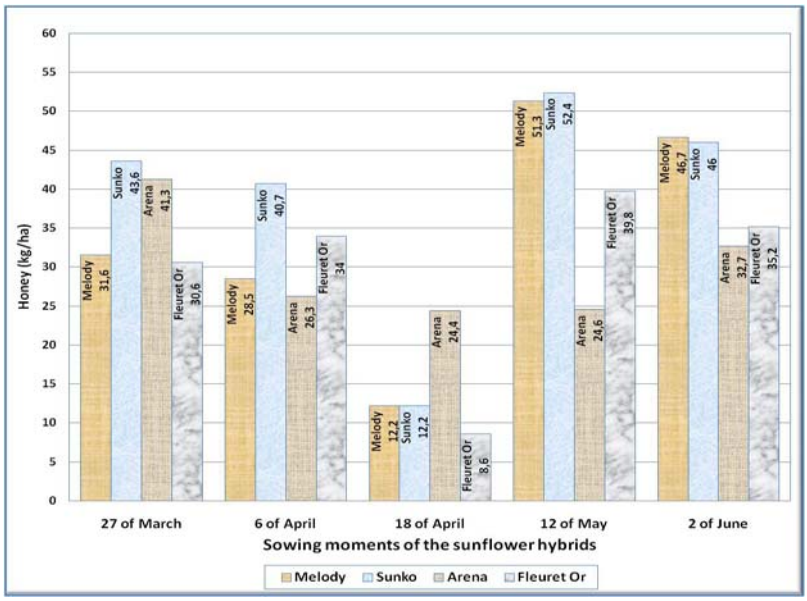

Figure 8. **Average melliferous potential at sunflower hybrids function of sowing moment, 2007**

Water deficit diminished nectar secretion and increased its sugar content, while water supply improved nectar secretion, and decreased the sugar content. Potential honey yield is firstly determined by the quantity of secreted nectar and then by the nectar sugar content.

CONCLUSIONS

- Melliferous potential at sunflower is determined by the biological factor (variety or hybrid that is cultivated) but this is significantly influenced by the climatic conditions, especially by water (rainfall) and temperature factors.
- The decreasing tendency registered on rainfall and increasing tendency registered on temperature over the two decades have had a negative influence on the melliferous potential at sunflower crop.
- Good water status of sunflower plants has a positive influence on the nectars secretion and honey yield that could be potentially obtained at a sunflower hybrid.
- Water deficit diminished nectar secretion and increased its sugar content, while water supply improved nectar secretion, and decreased its sugar content.
- High temperature during the flowering process has a negative influence on the glucidic index, decreasing the honey yield.
- The most significant influence on the honey yield, respectively on the glucidic index has the nectar secretion, this been most affected by the climatic conditions
- The unfavorable climatic conditions (severe drought and extremely high temperatures) from the year 2007 determined an early flowering time, a shorter flowering period for a head, but a longer flowering period within the crop.
- Period of intense nectar gathering by the melliferous bees, respectively the period between the moment when 10% of the sunflower heads have flowered and the time when only 10% sunflower heads are still in flower, varied between 14 and 18 days, in 2006, and between 13 and 21 days, in 2007.
- By sowing at different dates the melliferous potential at sunflower crop is different according to climatic conditions, but also according to sunflower hybrid.
- The relatively good potential honey yield cold be partly determined by the soil water reserve accumulated during fall winter rainfalls.

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