ANNALES
UNIVERSITATIS MARIAE CURIE-SKŁODOWSKA
LUBLIN—POLONIA

VOL. I, 13 SECTIO EEE 1993

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Sugars and Pollen Yield of Some Trees and Shrubs from *Fabaceae* Family

Wydajność cukrowa i pyłkowa niektórych drzew i krzewów
z rodziny motylkowatych (*Fabaceae*)

Investigations of pollen and honey efficiency of various ornamental trees nad shrubs were conducted in Poland for many years. The present paper is the part of them. It aimed at extending the knowledge of melliferous value of the most important species from *Fabaceae* family. Some of that plants were known only as producers of nectar (Jabłoński & Kołtowski 1992, Maurizio & Grafl 1967, Pelimon 1966, Szklanowska 1979). Now their sugars and pollen values were tested together as well as vitality and size of pollen grains.

MATERIAL AND METHODS

Two species from each of the tested, six genera from *Fabaceae* family were taken into investigations (Tab. 1). All trees and shrubs have grown in groups, on a podsolic soil, in Botanical Garden. Nectar and pollen samples were collected from flowers during the whole period of blooming for 3 following years.

Numbers of flowers and visiting them, in a top of blooming, honeybees were established on 1 m^2 of a crown surface and then converted per one tree or shrub (Szklanowska 1978).

The abundance of nectar in flowers was stated by the modified pippets method Jabłoński & Szklanowska (1979). Six samples of nectar were taken from 10 (30) flowers in each stage of blooming. The same number of flower's samples was tested to estimate their pollen efficiency. Pollen was rinsed away from anthers by means of ether (Warakomska 1972) and then the dry weight, size of pollen as well as the share of viability grains were established (Szklanowska 1984).

RESULTS

The main usefulness for honeybees of tested species persisted 10-20 days and occurred most frequently, between 15th May and 20th June. Their flowers supplied honeybees with nectar and pollen or only pollen. Pollening started already in buds. An access to nectar was connected, among others, with morphology of androecium (Fig. 1).

Tab.1. The florescence, sugars and pollen yield of the examined plants from *Fabaceae* family (average from years 1988–1990)

Genus and species of the examined plants	Period of blooming (in days)	Surface of crown in m^2	Flowers on $1m^2$ of crown	Sugars			Pollen		
				mg/one flower	g/$1m^2$ of crown	kg/ha	mg/one flower	g/$1m^2$ of crown	kg/ha
Amorpha fruticosa L.	V–VI (20–25)	5–15	4800	0,03	0,15	0,3–0,7	0,11	0,53	1–2
Caragana am. arborescens Lam.	V–VI	6–12	460	2,70	1,24	19–37	0,36	0,17	3–5
decorticans Hems	(10–20)	4–6	850	2,89	2,45	25–37	0,27	0,23	2–3
Colutea arborescens L.	V–VI	3–7	2340	2,05	4,80	36–84	1,23	2,88	20–50
orientalis Mill.	(14–21)	4–5	3119	2,01	6,27	63–78	1,77	5,52	50–70
Cytisus. ratisbonen. Schaff.	V–VI	2–5	2960	1,05	3,11	16–39	0,48	1,42	7–18
suspinus L.	(14–21)	1–2	8463	1,11	9,34	23–47	0,19	1,61	4–8
Laburnum ed. anagyroides Med.	V–VI	4–12	12905	–	–	–	0,30	3,87	40–120
alpinum Bercht.	(10–20)	4–10	6405	–	–	–	0,34	2,18	20–50
Robinia pseudoacacia L.	V–VI	9–25	6210	1,70	10,56	47–132	0,45	2,79	10–35
viscosa Vent.	(10–15)	7–20	5970	1,30	7,76	27–78	0,67	4,00	15–40

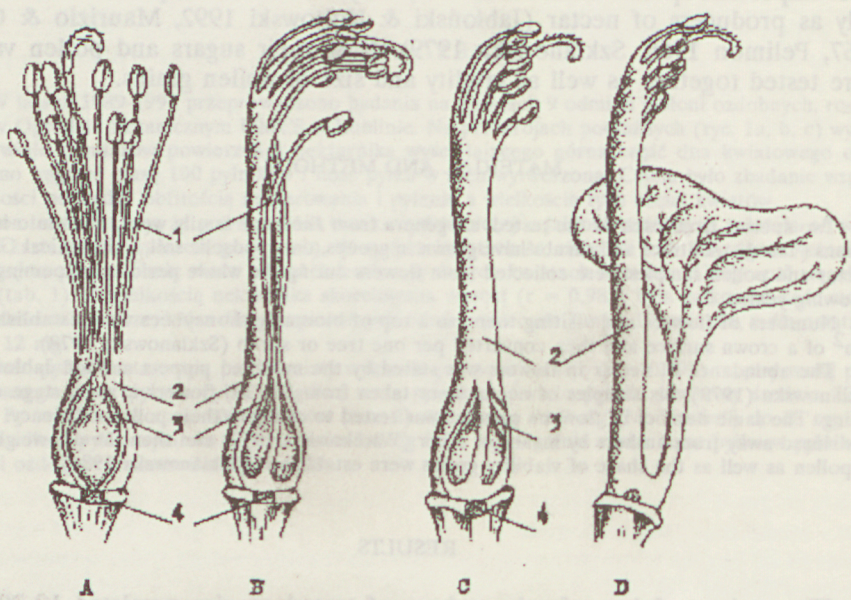

Fig. 1. Morphology of androecium [A – the orginal; B, C, D – according to M. Lipiński (1982)] A – *Amorpha* L., B – *Caragana Lam.*, *Colutea* L. and *Robina* L., C– *Cytisus* L., D – *Laburnum Med.* 1 – free filaments of anthers, 2 – filaments blended in a staminal tube or channel, 3 – slit across which insect suck nectar, 4 – sign of removed vexillum

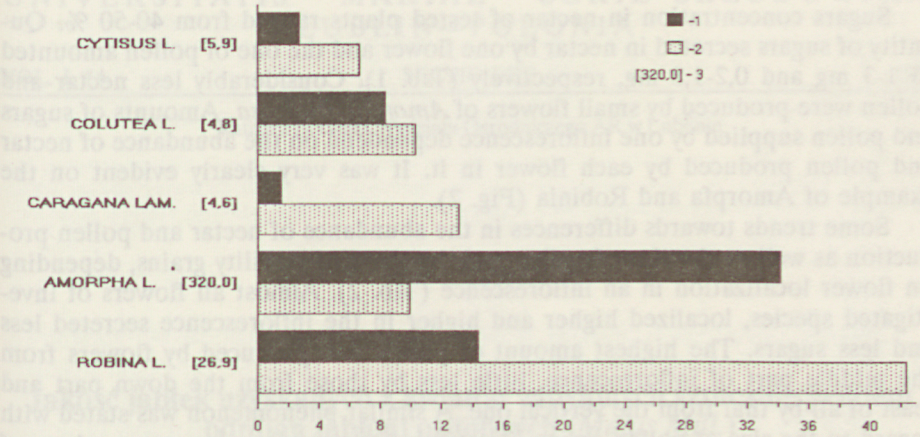

Fig. 2. Yield of sugars and pollen from one inflorescence: 1 – Pollen in mg, 2 – Sugars in mg, 3 – Number of flowers in inflorencence

Tab. 2. Differentiation of the amount of nectar secretion and quality of pollen in the flowers, depending on their localization in an inflorescence (average from years 1988 – 1990)

The examined features	Genus	Flowers from the inflorescence			Value of average
		first	middle	last	
Sugars content mg/10 flowers	Amorpha	0,3	0,4	0,2	0,34
	Caragana	26,5	24,6	10,3	22,12
	Colutea	25,5	19,3	10,6	18,80
	Cytisisus	13,3	11,1	8,6	11,04
	Laburnum	–	–	–	–
	Robinia	22,6	17,5	11,3	17,28
Quantity of pollen mg/10 flowers	Amorpha	0,9	1,1	0,7	0,84
	Caragana	3,5	3,7	3,6	3,64
	Colutea	10,4	14,0	11,4	12,76
	Cytisus	4,5	5,4	4,4	5,02
	Laburnum	3,5	3,7	2,9	3,50
	Robinia	3,8	4,3	3,2	3,98
Length of polar axis of grains in μm	Amorpha	24,4	29,9	21,0	27,02
	Caragana	17,8	24,4	20,0	22,22
	Colutea	33,1	35,5	31,0	34,12
	Cytisus	20,0	24,4	22,2	23,08
	Laburnum	20,0	24,4	22,2	23,08
	Robinia	26,6	33,4	29,9	31,34
Pollen viability in %	Amorpha	98,1	96,0	99,0	97,70
	Caragana	89,3	84,8	92,3	88,80
	Colutea	96,9	96,0	97,8	96,96
	Cytisus	97,0	95,4	96,9	96,43
	Laburnum	94,2	76,6	87,5	86,10
	Robinia	74,7	79,3	81,0	78,33
The percentage share of flowers in an inflorescence		20 %	60 %	20 %	–

Sugars concentration in nectar of tested plants ranged from 40-50 %. Quantity of sugars secreted in nectar by one flower and the one of pollen amounted to 1-3 mg and 0,2-1,8 mg, respectively (Tab. 1). Considerably less nectar and pollen were produced by small flowers of *Amorpha fruticosa*. Amounts of sugars and pollen supplied by one inflorescence dependend on the abundance of nectar and pollen produced by each flower in it. It was very clearly evident on the example of Amorpfa and Robinia (Fig. 2).

Some trends towards differences in the abundance of nectar and pollen production as well as the size of pollen and the share of viability grains, depending on flower localization in an inflorescence (Tab. 2). Almost all flowers of investigated species, localized higher and higher in the inflorescence secreted less and less sugars. The highest amount of pollen was produced by flowers from the middle part of inflorescence, little less by those from the down part and least of all by that from the vertical one. A similar phenomenon was stated with regard to the size of pollen grains. Relatively little smaller, percentage share of viability grains in flowers from the middle part of inflorescence was striking.

LITERATURE

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STRESZCZENIE

W okolicy Lublina w latach 1988-1990 badano wartość użytkową różnych gatunków drzew i krzewów z 6 rodzajów: *Amorpha L., Caragana Lam., Colutea L., Cytisus L., Laburnum Med., Robinia L.*. Przy pobieraniu nektaru stosowano zmodyfikowane metody Jabłońskiego i Szklanowskiej oraz Warakomskiej w oznaczeniach wydajności pyłkowej.

W warunkach badań główny pożytek wybranych roślin trwał 10-20 dni i przypadał na okres między 15 maja a 20 czerwca. Najintensywniej odwiedzane przez owady, zwłaszcza przez pszczoły (*Apis mellifera L.*) były kwiaty gatunków *Amorpha, Caragana* i *Robinia*. Małe kwiaty krzewów Amorpha fructiosa L. wytwarzały śladowe ilości nektaru i pyłku, jednak jeden ich kwiatostan (200-500 kwiatowy) dostarczał około 10 mg cukrów w nektarze i ponad 35 mg pyłku. Duże kwiaty pozostałych gatunków wydzielały 1-3 mg cukrów i produkowały 0,3-1,8 mg pyłku w pylnikach. Najobficiej nektarowały kwiaty rodzaju *Caragana, Colutea i Robinia*, a najlepiej pyliły *Colutea* oraz *Laburnum*. Masa pyłku (8-14 mg) z jednego kwiatostanu gatunków *Laburnum* dorównywała okazałym gronom drzew rodzaju Robinia (13-16 mg).

Ogólnie stwierdzono pewne tendencje do różnic w obfitości nektarowania i pylenia kwiatów w zależności od ich położenia w kwiatostanie.