

POLLEN ANALYSIS OF HONEYS FROM POLAND'S LUBELSZCZYŻNA REGIONS

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S u m m a r y

In the years 1990-2008, analyses were conducted for a pollen spectrum of 160 samples of honeys originating from five regions of Lubelszczyżna. A microscopic analysis of pollen sediments was carried out as postulated by Louveaux et al. (1978) and Moar (1985) using the palynological classification by Zander (1935, 1937). The honeys were evaluated according to the Polish Standard PN-88/A-77626 Bee honey (1988), which has not been used since 2003 but is still applied voluntarily.

Among the examined samples of honeys 142 were compatible with the Polish Standard (PS), including 67 specific honeys and 75 multifloral honeys, as well as 18 specific honeys not covered by the Polish Standard. From among the specific honeys identified in analyses: 45 originated from *Brassica napus*, 17 from *Tilia*, 4 from *Fagopyrum* and one from *Robinia*. Among those not registered in the PS: 6 honeys originated from *Salix*, 4 from *Rubus*, two each from *Phacelia* and *Prunus* and one each from *Lythrum salicaria*, *Malus*, *Solidago* and *Trifolium repens*.

The honeys from all 5 regions were found to contain the pollen of Brassicaceae, *Centaurea cyanus*, *Malus* type, *Prunus* type, *Rubus* type, *Salix*, *Taraxacum* type and *Trifolium repens* s.l, whereas among the pollen-bearing non-nectary plants, the honey contained pollen of *Plantago*, Poaceae and *Rumex*.

Keywords: honeys, pollen analysis, Lubelszczyżna (Poland).

INTRODUCTION

Pollen analysis of honeys is used to identify the sources of the nectar flow of the honeybees and plants pollinated by bees during a flower visit. Knowledge of the pollen composition of honey helps discriminate multifloral honeys from "specific" types of honeys. Specific types of honeys are more attractive and more eagerly purchased by consumers.

From an environmental perspective, the area of Lubelszczyżna, located in the central-eastern part of Poland, is acknowledged as "the green lungs of Poland". Kondracki (2000) has distinguished the following regional units

in the Lublin province: Southern-Podlaska Lowland, Polesie Podlaskie, Polesie Wołyńskie, Lubelska Upland with the region of Rostocze, Western-Wołyńska Upland with the Pobuże Valley and the Sandomierska Valley.

Pollen analyses of honeys have been conducted in the past in the area of the Lubelskie Voivodship by several authors. Lecewicz (1979) described the specific honeys of the southern part of Lubelszczyżna. Warakomska (1987) reported on the foraging values of willows (honey and pollen) and characterized multifloral commercial honeys and raspberry honeys (Warakomska,

1997a,b). The same author, together with Jaroszyńska (1992), described honeydews of the region of Roztocze. In turn, honeybee products of the northern part of the discussed province were described by Wróblewska (2002a,b).

The present study was aimed at identifying types of honeys obtained in the Lubelszczyzna area. This is a farming area which has undergone a transformation. The State Agricultural Farms (PGR) have been liquidated and individual beekeeping by beekeepers has developed.

MATERIAL AND METHODS

In the years 1990-2008, a total of 160 samples of honey were collected from individual beekeepers from 16 Districts located in the area of Lubelszczyzna (Tab. 1). The material collected was grouped according to regions stipulated by

Kondracki (2000) (Fig. 1). The honeys were classified in terms of their botanical origin, according to the Polish Standard PN-88/A-77626 Bee honey. The standard has not been used since 2003, yet it is in common use as it does not conflict with the Minister of Agriculture and Rural Development's regulations on the quality of honeys (Arszułowicz, 2005).

The determination of the botanical origin of the honeys was conducted by means of a pollen analysis elaborated by Louveaux et al. (1978) and accepted by FAO. Following Moar's recommendations (1985), at least 300 pollen grains were counted in a pollen sediment of each honey. Pollen of plants devoid of nectaries, including anemophilous, and entomophilous pollen-bearing ones, was distinguished in particular preparations. The percentage of pollen of nectariferous plants in individual



Fig. 1. Lubelszczyzna regions (Kondracki, 2000).

preparations served to discriminate various groups of honeys, as outlined in the Polish standard.

Pollen grains were determined by means of a palynological classification by Zander (1935-1941) and recommendations by Sawyer (1988). Based on the morphological characteristics of pollen grains, the pollen was classified - when possible - into species, genus, a specified type of structure or family. Available keys for pollen determinations, atlases (Ricciardelli d'Albore, 1998), reference preparations and a knowledge of plant phenology were applied to this end.

Six-furrow pollen grains within the Lamiaceae family were referred to as *Mentha* type. In Poland, the main forages of this family originate from taxa characterized by a similar morphological structure of pollen and include genus: *Mentha*, *Thymus* and *Origanum*. Zander (1935) classifies them as the *Majorana* type which, in Poland, is seldom cultivated

as a seasoning plant. The large three-furrow-porous pollen of the Asteraceae family is described as the *Cirsium* type. It might have originated from weed infestations of fields and barren lands with various species of the genus *Cirsium*, *Carduus* or *Onopordon*.

Results of the pollen analyses of particular honeys were grouped into the Districts of these 5 regions: Valley of Pobuże, Sandomierska Valley, Polesie Wołyńskie and Central-Mazowiecka Lowland, Rostocze, and Lubelska Upland (Tab. 2). For each region, pollen frequency was calculated in the honeys, which were then classified into five frequency classes (Tab. 3-7). Nectariferous and non-nectary plants providing pollen flow exclusively, were considered separately. A comparative analysis of pollen frequency of the major nectariferous taxa is depicted in Fig. 2. In turn, Tab. 8 presents examples of results of the pollen analysis of specific honeys and multifloral honey according to the Polish

Table 1

Origin of honey samples collected for the study

Region	District	Year	Number of samples from	
			district	region
Valley of Pobuże	Hrubieszów	1991, 1996	3	6
	Tomaszów Lubelski	1992, 2002	3	
Sandomierska Valley	Biłgoraj	1990, 1999	2	3
	Janów Lubelski	2001	1	
Polesie Wołyńskie and Central-Mazowiecka Lowland	Chełm	2001	1	13
	Łęczna	2001-2003	6	
	Parczew	1990, 2001	3	
	Ryki	2006	1	
Rostocze	Włodawa	2000, 2002	2	12
	Zamość	1997, 1990, 2001, 2006	12	
Lubelska Upland	Krasnystaw	2003-2004	4	126
	Kraśnik	1990, 1999-2000, 2002-2004, 2007	16	
	Lubartów	1996, 1998, 2000-2001	6	
	Lublin	1992, 1997-1999, 2001-2007	35	
	Opole Lubelskie	2001-2003, 2008	12	
	Puławy	1991-1993, 1998, 2000-2004	53	
Total			160	

Standard. Tab. 9 provides data on the honeys not included in the Standard.

Microscopic preparations of the pollen sediments of the honeys examined are kept at the Department of Botany, University of Life Sciences in Lublin.

RESULTS AND DISCUSSION

The classification of honey, depending on its botanical origin, into a specific group is determined not only by organoleptic characteristics of a product but also by percentage contribution of pollen in honey precipitate (Louveaux et al., 1978). The Polish Standard makes a distinction from among the nectar specific honeys. The Polish Standard distinguishes rape, buckwheat, and heather as honeys with a pollen contribution in which the dominant taxon reaches at least 45%. The Polish Standard also recognizes as distinct: robinia honey and lime-tree honey with a dominant pollen contribution of 30% and 20%, respectively. The diversified contribution of the pollen depends on the distribution of nectaries in a flower and the degree of nectar sprinkling with its own pollen. The other honeys described in the Polish standard include multifloral honeys, honeydews from coniferous and

broadleaved dewes and nectar-honeydews. In Poland, other specific honeys are also produced that have not been covered by the Standard.

The results of the pollen analyses of the honeys from 5 regions of Lubelszczyzna are presented in Tab. 2. In the 160 samples of the material examined, a total of 142 honeys were distinguished that were consistent with the Polish Standard, including 67 specific honeys and 75 multifloral honeys, as well as 18 specific honeys not included in the Polish Standard. From among the specific honeys identified in analyses: 45 originated from *Brassica napus*, 17 from *Tilia*, 4 from *Fagopyrum* and one from *Robinia*, whereas amongst those not registered in the PS: 6 honeys originated from *Salix*, 4 from *Rubus*, two from *Phacelia* and *Prunus* each and one from each of *Lythrum salicaria*, *Malus*, *Robinia*, *Solidago* and *Trifolium repens* (Tab. 2.).

The number of honeys originating from particular regions varied widely. The highest number was 126 samples, found in 6 Districts located in the area of the Lubelska Upland. In this typically agricultural area apiaries are distributed with varying degrees of density. The predominant sources of forage in the area

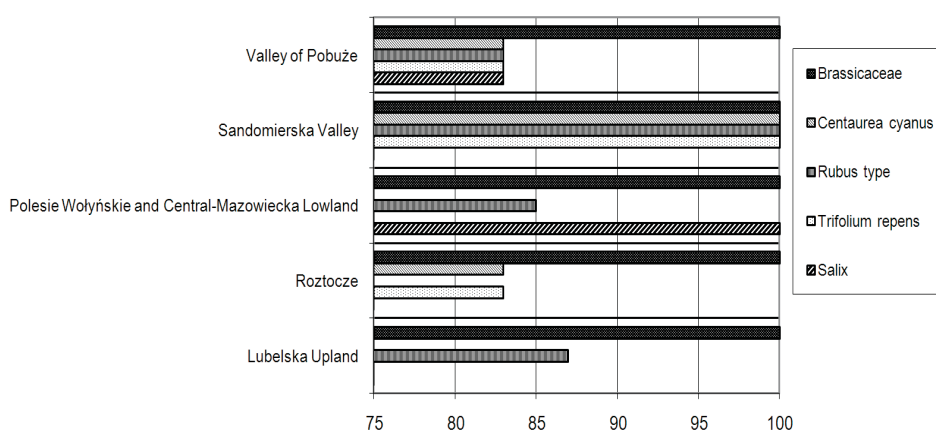


Fig. 2. Pollen frequency of the most important nectariferous plants in honeys of Lubelszczyzna (%)

Table 2

Honey distribution in the area of Lubelszczyzna

Region	District (No of samples)	Type of honey (contribution of dominant pollen in %)		
		according to the Polish Standard	not covered by the Polish Standard	
Valley of Pobuże	Hrubieszów (3)	<i>Brassica napus</i> (90)	-	
	Tomaszów Lubelski (3)	multifloral (-)	-	
Sandomierska Valley	Biłgoraj (2)	multifloral (-)	-	
	Janów Lubelski (1)	multifloral (-)	-	
Polesie Wołyńskie and Central-Mazowiecka Lowland	Chelm (1)	<i>Brassica napus</i> (98)	-	
	Łęczna (6)	multifloral (-)	<i>Lythrum salicaria</i> (45) <i>Salix</i> (53,72, 83)	
	Parczew (3)	<i>Brassica napus</i> (47, 50)	-	
		multifloral (-)	-	
	Włodawa (2)	<i>Brassica napus</i> (56)	-	
		<i>Robinia</i> (29)	-	
Ryki (1)	-	<i>Salix</i> (71)		
Roztocze	Zamość (12)	<i>Brassica napus</i> (45, 52, 53, 64, 67, 79)	-	
		<i>Fagopyrum</i> (45)		
		multifloral (-)		
Lubelska Upland	Krasnystaw (4)	<i>Brassica napus</i> (46)	<i>Phacelia</i> (45)	
		multifloral (-)		
	Kraśnik (16)	<i>Brassica napus</i> (51, 52)	<i>Solidago</i> (57)	
		multifloral (-)	<i>Rubus</i> (89)	
			<i>Salix</i> (57)	
			<i>Prunus</i> (75)	
			<i>Malus</i> (50)	
	Lubartów	<i>Fagopyrum</i> (45)	-	
		multifloral (-)		
	Lublin (35)	<i>Brassica napus</i> (45, 47, 48, 48, 48, 50, 56, 57, 57, 58, 59, 60, 61)	<i>Trifolium repens</i> (47)	
		multifloral (-)	<i>Salix</i> (72)	
			<i>Tilia</i> (23)	<i>Phacelia</i> (53)
			multifloral (-)	<i>Prunus</i> (61)
	Opole Lubelskie (12)	<i>Brassica napus</i> (54, 63, 70, 79, 96)	<i>Rubus</i> (47, 88, 92)	
		<i>Fagopyrum</i> (53)		
multifloral (-)				
Puławy (53)	<i>Brassica napus</i> (45, 46, 46, 47, 48, 49, 49, 51, 52, 52, 65, 68)	-		
	<i>Tilia</i> (21, 25, 27, 28, 34, 38, 40, 43, 48, 52, 63, 78, 85, 96, 96, 98)			
	<i>Fagopyrum</i> (58)			
	multifloral (-)			
Total		142	18	

Table 3

Pollen frequency in honeys from the Valley of Pobuże

%	Pollen taxa of plants	
	nectariferous	nectary-less
100-80	<i>Brassicaceae, Centaurea cyanus, Rubus</i> type, <i>Trifolium repens</i> s.l., <i>Salix</i>	<i>Papaver</i> , <i>Poaceae</i>
80-60	<i>Anthriscus</i> type, <i>Malus</i> type, <i>Mentha</i> type, <i>Taraxacum</i> type, <i>Tilia</i> , <i>Trifolium pratense</i> , <i>Vicia</i> type, unknown	None
60-40	<i>Achillea</i> type, <i>Aesculus</i> , <i>Cirsium</i> type, <i>Heracleum</i> type, <i>Melilotus</i> , <i>Prunus</i> type	<i>Ranunculus</i> , <i>Rumex</i> , <i>Zea</i>
40-20	<i>Allium</i> type, <i>Cucumis</i> , <i>Echium</i> , <i>Fagopyrum</i> , <i>Frangula</i> , <i>Lamium</i> type, <i>Phacelia</i> , <i>Phaseolus</i> , <i>Polygonum bistorta</i>	<i>Artemisia</i> , <i>Filipendula</i> , <i>Fragaria</i> , <i>Sambucus nigra</i> , <i>Urtica</i>
<20	<i>Arctium</i> , <i>Centaurea scabiosa</i> , <i>Chamaenerion</i> , <i>Cornus</i> , <i>Crataegus</i> , <i>Geranium</i> , <i>Helianthus</i> type, <i>Lotus</i> , <i>Lythrum</i> , <i>Myosotis</i> , <i>Ribes</i>	<i>Anemone</i> , <i>Betula</i> , <i>Chenopodium</i> , <i>Corylus</i> , <i>Plantago</i> , <i>Rosa</i> , <i>Rubiaceae</i>

Table 4

Pollen frequency in honeys of Sandomierska Valley

%	Pollen taxa of plants	
	nectariferous	nectary-less
100-80	<i>Brassicaceae, Centaurea cyanus, Fagopyrum</i> , <i>Malus</i> type, <i>Rubus</i> type, <i>Taraxacum</i> type, <i>Trifolium pratense</i> , <i>T. repens</i> s.l., unknown	None
80-60	<i>Cornus</i> , <i>Prunus</i> type, <i>Salix</i>	<i>Hypericum</i> , <i>Plantago</i> , <i>Poaceae</i>
60-40	None	None
40-20	<i>Achillea</i> type, <i>Aesculus</i> , <i>Anthriscus</i> type, <i>Arctium</i> , <i>Calluna</i> , <i>Caryophyllaceae, Centaurea jacea</i> type, <i>Frangula</i> , <i>Galeopsis</i> , <i>Lotus</i> , <i>Lythrum</i> , <i>Nicotiana</i> , <i>Mentha</i> type, <i>Solidago</i>	<i>Artemisia</i> , <i>Bellis</i> , <i>Lupinus</i> , <i>Papaver</i> , <i>Quercus</i> , <i>Rosa</i> , <i>Rumex</i> , <i>Sambucus nigra</i>

Table 5

Pollen frequency in honeys of Polesie Wołyńskie and Central-Mazowiecka Lowland

%	Pollen taxa of plants	
	nectariferous	nectary-less
100-80	<i>Brassicaceae, Rubus</i> type, <i>Salix</i> , unknown	None
80-60	<i>Frangula</i> , <i>Malus</i> type, <i>Prunus</i> type	None
60-40	<i>Aesculus, Centaurea cyanus, Fagopyrum, Robinia, Taraxacum</i> type, <i>Trifolium repens</i> s.l.	<i>Fragaria</i> , <i>Poaceae, Quercus</i> , <i>Ranunculus, Rumex</i>
40-20	<i>Achillea</i> type, <i>Anthriscus</i> type, <i>Cirsium</i> type, <i>Crataegus</i> , <i>Lamium</i> type, <i>Lotus uliginosus, Lythrum, Melilotus, Phacelia, Polygonum bistorta</i> , <i>Tilia, Vicia</i> type	<i>Betula, Carex, Hypericum</i> , <i>Secale</i>
<20	<i>Acer pseudoplatanus, Caryophyllaceae</i> , <i>Centaurea scabiosa, Cerinthe, Convolvulus, Geum, Centaurea jacea</i> type, <i>Lotus, Lychnis flos-cuculi, Mentha</i> type, <i>Onobrychis, Ornithopus</i> , <i>Polygonum convolvulus, Ribes, Scrophulariaceae, Solidago, Trifolium</i> <i>pratense, Vaccinium, Viola tricolor</i> type	<i>Alnus, Bellis, Chenopodium</i> , <i>Corylus, Filipendula, Galium</i> , <i>Pinus, Plantago, Rosa</i> , <i>Sambucus nigra, Spiraea</i> , <i>Ulmus, Urtica, Zea</i>

Table 6

Pollen frequency in honeys of Roztocze

%	Pollen taxa of plants	
	nectariferous	nectary-less
100-80	Brassicaceae, <i>Centaurea cyanus</i> , <i>Tilia</i> , <i>Trifolium repens</i> s.l., unknown	None
80-60	<i>Achillea</i> type, <i>Fagopyrum</i> , <i>Malus</i> type, <i>Prunus</i> type, <i>Rubus</i> type, <i>Salix</i>	None
60-40	<i>Cirsium</i> type, <i>Galeopsis</i> , <i>Heracleum</i> type, <i>Phaseolus</i> , <i>Polygonum bistorta</i> , <i>Trifolium pratense</i> , <i>Vicia</i> type	<i>Artemisia</i> , <i>Papaver</i> , Poaceae, <i>Plantago</i> , <i>Rumex</i>
40-20	<i>Aesculus</i> , <i>Crataegus</i> , <i>Helianthus</i> type, <i>Lamium</i> type, <i>Lotus</i> , <i>Phacelia</i>	<i>Chenopodium</i> , <i>Fragaria</i> , <i>Hypericum</i> , <i>Zea</i>
<20	<i>Acer pseudoplatanus</i> , <i>Allium</i> type, <i>Arctium</i> , <i>Aster</i> type, <i>Chamaenerion</i> , <i>Convolvulus</i> , <i>Echium</i> , <i>Frangula</i> , <i>Genista</i> type, <i>Centaurea jacea</i> type, <i>Geranium</i> , <i>Geum</i> , <i>Impatiens</i> , <i>Lychnis flos-cuculi</i> , <i>Lythrum</i> , <i>Mentha</i> type, <i>Nicotiana</i> , <i>Onobrychis</i> , <i>Parthenocissus</i> , <i>Solidago</i> , <i>Stachys</i> , <i>Symphytum</i> , <i>Syringa</i> , <i>Viola tricolor</i> type	<i>Bellis</i> , <i>Betula</i> , <i>Carex</i> , <i>Filipendula</i> , <i>Juglans</i> , <i>Pinus</i> , <i>Quercus</i> , <i>Urtica</i> , <i>Verbascum</i>

Table 7

Pollen frequency in honeys of Lubelska Upland

%	Pollen taxa of plants	
	nectariferous	nectary-less
100-80	Brassicaceae, <i>Rubus</i> type, unknown	none
80-60	<i>Centaurea cyanus</i> , <i>Malus</i> type, <i>Prunus</i> type, <i>Trifolium repens</i> s.l.	Poaceae
60-40	<i>Achillea</i> type, <i>Aesculus</i> , <i>Anthriscus</i> type, <i>Fagopyrum</i> , <i>Salix</i> , <i>Taraxacum</i> type, <i>Tilia</i>	<i>Rumex</i>
40-20	<i>Crataegus</i> , <i>Frangula</i> , <i>Lamium</i> type, <i>Melilotus</i> , <i>Phacelia</i> , <i>Polygonum bistorta</i> type, <i>Robinia</i> , <i>Trifolium pratense</i> , <i>Vicia</i> type	<i>Bellis</i> , <i>Betula</i> , <i>Filipendula</i> , <i>Fragaria</i> , <i>Papaver</i> , <i>Plantago</i> , <i>Quercus</i> , <i>Ranunculus</i> , <i>Urtica</i>
<20	<i>Acer pseudoplatanus</i> , <i>Acer</i> , <i>Agrimonia</i> , <i>Allium</i> type, <i>Althaea rosea</i> , <i>Arctium</i> , <i>Aster</i> type, <i>Berberis</i> , <i>Bryonia</i> , <i>Calluna</i> , Campanulaceae, Caryophyllaceae, <i>Centaurea jacea</i> type, <i>Cerinthe</i> , <i>Chamaenerion</i> , <i>Cirsium</i> type, <i>Convolvulus</i> , <i>Cornus</i> , <i>Diplotaxis</i> , <i>Echium</i> , <i>Galeopsis</i> , <i>Genista</i> type, <i>Helianthus</i> type, <i>Heracleum</i> type, <i>Impatiens</i> , <i>Lotus</i> , <i>Lotus uliginosus</i> , <i>Lychnis flos-cuculi</i> , <i>Lythrum</i> , <i>Medicago</i> , <i>Melampyrum</i> , <i>Mentha</i> type, <i>Myosotis</i> , Onagraceae, <i>Ornithopus</i> , <i>Parthenocissus</i> , <i>Phaseolus</i> , <i>Polygonum persicaria</i> type, <i>Ribes</i> , <i>Salvia</i> type, Scrophulariaceae, <i>Sedum</i> , <i>Solidago</i> , <i>Syringa</i> , <i>Tussilago</i> , <i>Vaccinium</i> , <i>Viola tricolor</i> type	<i>Alnus</i> , <i>Anemone</i> , <i>Artemisia</i> , <i>Carex</i> , <i>Carpinus</i> , <i>Cerealia</i> , <i>Chenopodium</i> , <i>Corylus</i> , <i>Fraxinus</i> , <i>Hypericum</i> , <i>Iva</i> type, <i>Juglans</i> , <i>Juniperus</i> , <i>Lupinus</i> , <i>Nuphar</i> , <i>Picea</i> , <i>Pinus</i> , <i>Populus</i> , <i>Rheum</i> , Rubiaceae, <i>Rosa</i> , <i>Sambucus nigra</i> , <i>Sanguisorba</i> , <i>Secale</i> , <i>Spiraea</i> , <i>Taxus</i> , <i>Verbascum</i> , <i>Ulmus</i> , <i>Zea</i>
Spores of <i>Filicales</i> found		

include crops of rape and buckwheat as well as orchards and gardens. Forest and meadow areas, weeds, local lime-trees and horse chestnut trees also play a significant role.

In the area of the Lubelska Upland, the analyses enabled discriminating 65 specific honeys and 60 multifloral honeys (Tab. 2).

The specific honeys consistent with the Polish Standard included: 32 honeys from *Brassica napus*, 16 from *Tilia* and 3 from *Fagopyrum*. In turn, 13 specific honeys were not covered by the PS but were identified in the area. They originated from different forages, from crops of *Phacelia*, fruit orchards, *Trifolium repens* and

Table 8

Contribution of pollen taxa in selected honeys according to the Polish Standard (%)

Region, species of honey	Pollen participation of plants (%)				Nectary-less
	45-100 dominant	16-45 accessory	3-15 single	<3 sporadic	
Roztocze (1997) <i>Brassica napus</i>	<i>Brassica napus</i> (64%)	none	<i>Centaurea cyanus</i> , <i>Malus</i> type, <i>Phaseolus</i> , <i>Prunus</i> type, <i>Salix</i>	<i>Achillea</i> type, <i>Aesculus</i> , <i>Fagopyrum</i> , <i>Helianthus</i> type, <i>Heracleum</i> type, <i>Lamium</i> type, <i>Lotus</i> , <i>Polygonum bistorta</i> , <i>Robinia</i> , <i>Rubus</i> type, <i>Taraxacum</i> type, <i>Tilia</i> , <i>Trifolium repens</i> s.l., <i>Vicia</i> type, <i>Viola tricolor</i> type, unknown	<i>Chenopodium</i> , <i>Plantago</i> , <i>Secale</i> , <i>Zea</i>
Lubelska Upland (2003) <i>Fagopyrum</i>	<i>Fagopyrum</i> (53%)	<i>Taraxacum</i> type	<i>Achillea</i> type, Brassicaceae, <i>Tilia</i>	<i>Agrimonia</i> , <i>Lamium</i> type, <i>Melilotus</i> type, <i>Polygonum persicaria</i> type, <i>Rubus</i> type, <i>Trifolium repens</i> s.l., <i>Vicia</i> type, unknown	<i>Artemisia</i> , <i>Bellis</i> , <i>Chenopodium</i> , <i>Papaver</i> , <i>Plantago</i> , Poaceae, <i>Rumex</i>
Lubelska Upland (1991) <i>Tilia</i>	<i>Tilia</i> (63%)	<i>Helianthus</i> type	Brassicaceae	<i>Achillea</i> type, <i>Anthriscus</i> type, <i>Frangula</i> , <i>Phacelia</i> , <i>Rubus</i> type, <i>Salix</i> , <i>Trifolium repens</i> s.l., <i>Vicia</i> type, unknown	<i>Fragaria</i> , <i>Papaver</i> , Poaceae, <i>Rumex</i> , <i>Secale</i>
Polesie Wołyńskie (2002) <i>Robinia</i>	none	<i>Robinia</i> (29%) Brassicaceae	<i>Anthriscus</i> type, <i>Cirsium</i> type, <i>Malus</i> type, <i>Rubus</i> type, unknown	Caryophyllaceae, <i>Fagopyrum</i> , <i>Phacelia</i> , <i>Ribes</i> , <i>Salix</i> , <i>Taraxacum</i> type, <i>Viola tricolor</i> type, unknown	<i>Carex</i> , <i>Fragaria</i> , Poaceae, <i>Ranunculus</i> , <i>Rumex</i>
Lubelska Upland (1999) Multifloral	none	<i>Aesculus</i> , <i>Rubus</i> type	<i>Acer</i> , Brassicaceae, <i>Malus</i> type, <i>Prunus</i> type, <i>Ribes</i> , <i>Salix</i>	<i>Berberis</i> , <i>Centaurea cyanus</i> , <i>Crataegus</i> , <i>Robinia</i> , <i>Taraxacum</i> type, <i>Trifolium repens</i> s.l., <i>Tussilago</i> , unknown	<i>Bellis</i> , <i>Pinus</i> , <i>Potentilla</i> , <i>Quercus</i> , <i>Spiraea</i>

Solidago. In the region of Lubelszczyzna, Lecewicz (1984) also identified honeys from *Centaurea cyanus* and *Onobrychis* not occurring in the material analyzed in this study. The results of the analyses demonstrated a 100% frequency of Brassicaceae pollen in honeys from all areas of Lubelszczyzna. This is consistent with the opinion of Lecewicz (1984) on the high attractiveness of the nectar flow of representatives of that family to honeybees.

Willow honeys were registered on Polesie Wołyńskie and the Lubelska Upland. They were in the northern part of the province where 23 honeys of that type were determined by Wróblewska

(2002a,b). The five raspberry honeys distinguished in this study originated from the Lubelska Upland, which is characterized by numerous plantations of raspberry. Beekeepers move their hives there in the blooming season. In domestic literature, only Warakomska (1997b) characterized raspberry honeys originating from the area of Kraśnik.

It is also noteworthy that honey from *Lythrum salicaria*, not registered in the Polish Standard, was distinguished in Polesie Wołyńskie. This is an area with abundant boggy meadows and swamps. This honey was characterized by a high contribution of pollen (45%) of the

Table 9

Contribution of pollen taxa in selected honeys not covered by the Polish Standard (%)

Region, species of honey	Pollen participation of plants (%)				Nectary-less
	45-100 dominant	16-45 accessory	3-15 single	<3 sporadic	
Lubelska Upland (2007) <i>Phacelia</i>	<i>Phacelia</i> (53%)	Brassicaceae	<i>Trifolium repens</i> s.l.	<i>Anthriscus</i> type, <i>Centaurea cyanus</i> , <i>Melilotus</i> , <i>Rubus</i> type, <i>Tilia</i> , <i>Vicia</i> type, unknown	Poaceae, <i>Rumex</i>
Lubelska Upland (2004) <i>Malus</i>	<i>Malus</i> (53%)	<i>Prunus</i> type	Brassicaceae, <i>Rubus</i> type, <i>Taraxacum</i> type	<i>Aesculus</i> , <i>Crataegus</i> , <i>Ribes</i> , <i>Salix</i> , unknown	<i>Anemone</i> , <i>Fragaria</i> , <i>Quercus</i>
Lubelska Upland (2001) <i>Trifolium</i>	<i>Trifolium repens</i> s.l. (47%)	Brassicaceae	<i>Fagopyrum</i> , <i>Tilia</i> , <i>Trifolium pratense</i>	<i>Achillea</i> type, <i>Centaurea cyanus</i> , <i>Mentha</i> type, <i>Prunus</i> type, <i>Rubus</i> type, unknown	<i>Bellis</i> , Poaceae, <i>Urtica</i>
Polesie Wołyńskie (2002) <i>Lythrum salicaria</i>	<i>Lythrum salicaria</i> (45%)	none	Brassicaceae, <i>Fagopyrum</i> , <i>Lotus uliginosus</i> , <i>Melilotus</i> , <i>Salix</i> , <i>Solidago</i> , <i>Trifolium repens</i> s.l.	<i>Achillea</i> type, <i>Centaurea cyanus</i> , <i>Cirsium</i> type, <i>Frangula</i> , <i>Mentha</i> type, <i>Phacelia</i> , <i>Polygonum convolvulus</i> , <i>Rubus</i> type, unknown	<i>Filipendula</i> , Poaceae, <i>Rosa</i> , <i>Rumex</i> , <i>Urtica</i>
Lubelska Upland (1997) <i>Rubus</i> type	<i>Rubus</i> type (88%)	none	Brassicaceae, <i>Salix</i>	<i>Aesculus</i> , <i>Centaurea cyanus</i> , <i>Convolvulus</i> , <i>Crataegus</i> , <i>Lamium</i> type, <i>Malus</i> type, <i>Trifolium pratense</i> , <i>T. repens</i> s.l., <i>Vaccinium</i> , unknown	<i>Carex</i> , <i>Corylus</i> , <i>Juniperus</i> , <i>Rumex</i>
Lubelska Upland (2003) <i>Solidago</i>	<i>Solidago</i> (88%)	<i>Calluna</i>	Brassicaceae	<i>Aster</i> type, <i>Centaurea cyanus</i> , <i>Genista</i> type, <i>Melampyrum</i> , <i>Prunus</i> type, <i>Salix</i> , <i>Trifolium pratense</i> , <i>T. repens</i> s.l., unknown	none

dominant taxon. To date, no single-species honey has been obtained from that plant under experimental conditions, hence the degree of its nectar sprinkling with own pollen expressed per 1 g of honey is still unknown. Nevertheless, *Lythrum* is recognized as a plant of boggy areas intensively visited by honeybees (Lipiński, 1982).

From among the honeys analyzed in the study, the most numerous group (48.7%) was the multifloral honey group. In those honeys a high frequency of pollen grains of the Brassicaceae, *Centaurea cyanus*, *Rubus*

type and fruit trees (*Malus* and *Prunus*), were noted. The contribution of these pollens in particular honeys was considered to be that of secondary pollen.

The honeys from all 5 regions were found to contain pollen of Brassicaceae, *Centaurea cyanus*, *Malus* type, *Prunus* type, *Rubus* type, *Salix*, *Taraxacum* type and *Trifolium repens* s.l. Among the pollen-bearing non-nectary plants, the honey contained pollen of *Plantago*, Poaceae and *Rumex*.

From among the crops, a 60-40% frequency was noted for pollen of

Phaseolus from the area of Roztocze. There was much less pollen from *Allium* type, *Cucumis*, *Nicotiana* and *Ribes*.

The pollen spectrum of the honeys analyzed in the study indicates the utilization of forages by honeybees over the entire apicultural season. It started with *Tussilago* blooming in the early spring, through numerous taxa of the summer period, to late summer and autumn *Calluna*. One exemplary sample was selected from each honey. Their pollen spectrum was collated in Tab. 8 for honeys consistent with the PS. Tab. 9 shows those not included in the Polish Standard.

CONCLUSIONS

1. The most frequent honeys obtained in the Lubelszczyzna area are multifloral and specific honeys from *Brassica napus* and *Tilia*. The honeys obtained from *Fagopyrum* are less frequent.

2. Among the honeys not included in the Polish Standard, specific honeys from *Salix*, *Rubus*, *Phacelia* and *Prunus* can be obtained. They may be also obtained from other plant species but this is rare.

3. Among the nectariferous taxa, Brassicaceae, *Centaurea cyanus*, *Prunus* type, *Rubus* type, *Salix*, *Taraxacum* type, *Tilia* and *Trifolium repens* s.l. appeared to be main sources of bee flow.

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ANALIZA PYŁKOWA MIODÓW LUBELSZCZYZNY**Wróblewska A., Warakomska Z.****S t r e s z c z e n i e**

W latach 1990-2008 badano spektrum pyłkowe 160 próbek miodów z pięciu regionów położonych na terenie Lubelszczyzny. Mikroskopową analizę pyłkową osadów przeprowadzono według wskazań Louveaux et al. (1978) oraz Moara (1985) z zastosowaniem klasyfikacji palinologicznej Zandera (1935, 1937). Oceny miodów dokonano zgodnie z zaleceniami Polskiej Normy PN-88/A-77626 Miód pszczeły (1988), która od 2003 roku już nie obowiązuje ale nadal stosowana jest na zasadzie dobrowolności.

W badanym materiale wyróżniono 142 miody zgodne z Polską Normą (PN), w tym 67 odmianowych i 75 wielokwiatowych oraz 18 miodów odmianowych poza tą normą. Wśród miodów odmianowych zarejestrowano: 45 z *Brassica napus*, 17 z *Tilia*, 4 z *Fagopyrum* i jeden z *Robinia*, zaś poza PN: 6 miodów z *Salix*, 4 z *Rubus*, po dwa z *Phacelia* i *Prunus* oraz po jednym z *Lythrum salicaria*, *Malus*, *Solidago* i *Trifolium repens*.

W miodach ze wszystkich 5 regionów notowano obecność pyłku Brassicaceae, *Centaurea cyanus*, *Malus* type, *Prunus* type, *Rubus* type, *Salix*, *Taraxacum* type i *Trifolium repens* s.l., zaś wśród pyłkodajnych roślin beznektarnikowych *Plantago*, Poaceae i *Rumex*.

Słowa kluczowe: miody, analiza pyłkowa, Lubelszczyzna (Polska).