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## **Changes and Evolutions of Beekeeping Sector in Poland between 2010-2015, in the Context of EU Adhesion**

**Abstract.** Changes in the beekeeping sector in Poland in the years 2010 to 2015 with particular focus on regional differences are discussed. The situation of amateur and professional beekeepers in terms of their socioeconomic statuses with regard to number of bee colonies, productivity, number of hives per 1 km sq., losses in the bee colonies is presented. The main sources of information, including the Central Statistical Office (CSO), FAOSTAT 2016, the reports and studies of S. Pieniążek Research Institute of Pomology and Floriculture in Skierniewice Division of Apiculture in Puławy, the materials of the Polish Association of Beekeepers. The comparative and descriptive methods have been applied in the analysis of the research problem. The article shows who is the beekeepers, how is the situation in the number and structure of bee colonies by province, inform about average size of an apiary, and density of honeybee colonies (number of colonies per 2 km sq.). The fragmentation of apiaries in Poland is a factor that has direct impact on the low profitability of production, while the associated high costs, small scale of production, and lack of investment capital, significantly reduce the economic results and hinder further development.

**Key words:** beekeeping sector, beekeepers, bee colonies, colonies, honey production

### **Introduction**

When assessing the last two decades of the beekeeping industry in Poland two distinctive periods can be identified. The first period covers the functioning before Poland's accession to the EU when the beekeeping was indirectly supported by the state budget. Such support included, among others, co-financing of the, so called, biological progress in breeding the bees or the purchases of honey within the framework of intervention activity of Agricultural Market Agency (purchase in summer season and sales in winter and spring) (Borowska, 2011a). Besides, the beekeepers could also buy sugar for feeding the bee colonies at a preferential price. Also, the high level of customs duties on honey imports used to act as a protective instrument in the pre-accession period. The second period covers the time after Poland's accession to the EU in 2004 which is characterized by the increased institutional support for the beekeeping sector through the implementation of "Support for Bee Products Market" mechanism operating under the successive three-years' National Apiculture Programs (Borowska, 2010, 2013). The resulting favorable changes of organizational, sanitary-hygienic, technological and technical nature observed in the apiary farms, especially in the farms run by the beekeepers associated in apiculture organizations, can be referred to the economic aspects of managing the apiaries, as well as the enhancing quality of apiculture products such as: royal jelly, wax, propolis, bee venom, pollen, bee bread, and honey are the main source generating income for the beekeepers in Poland (Wilde, 1998, 2016). Both, the objective factors (beyond control of the beekeepers, such as weather conditions, availability of honey flows, etc.), and subjective factors: formal (the

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well-developed educational and scientific backup, well-functioning structures of the beekeepers associations, high quality of the beekeeping equipment, and a wide range of domestic honey assortment offered at competitive prices) as well as informal (traditions, customs, habits, social relations, etc.) significantly contributed to the development of honey production, especially in the years 2000-2015. The fragmentation and amateur nature as well as the small share of professional apiaries and individual and usually intuitive marketing of apiary products are still the main weaknesses of the Polish beekeeping sector (Semkiw et al., 2007, 2012, 2015; Majewski, 2010; Wilde, 2016). The negative factors include also high production costs, growing share of imported honey on the domestic market, and export of high-quality raw materials, etc. In consideration of these few reasons the issue of the beekeeping industry in Poland and the relevant changes are worth assessment

### **Objective, source material, and research methods**

The objective of this paper is to show changes in the beekeeping sector in Poland in the years 2010-2015, with particular account for the differences between the regions. The secondary sources of information, including the statistical yearbooks issued by the Central Statistical Office (CSO), FAOSTAT, Eurostat, the reports and studies of S. Pieniżek Research Institute of Pomology and Floriculture in Skierniewice Division of Apiculture in Puławy, the materials of the Polish Association of Beekeepers, foreign trade database, are used in this study. The comparative and descriptive methods have been applied in the analysis of the research problem.

### **The situation in the beekeeping sector in Poland**

In 2009 approximately 71.2% of the beekeepers were still members of the beekeeping organizations, however that number decreased in the subsequent years to drop to 62.5% in 2015 when about 39 thousand beekeepers owned a total of over 1 million bee colonies, i.e. 72.5% of their total number (tab.1). According to CSO, about 3/5 of the bee colonies were run by the beekeepers having their own farms, the remaining part belonged to people not connected professionally with agriculture. The number of professional beekeepers in the country grew steadily, albeit rather slowly. In the period from 2009 to 2015 they accounted for less than 0.55 % of the total number of beekeepers with 237 persons at the beginning of that period and 324 six years later. According to the Institute of Horticulture in Skierniewice in November 2015, there were over 1.44 million bee colonies in the apiaries in Poland, out of which over 88 thousand in commercial apiaries (with more than 150 hives) which constituted a little over 6% of hives in the country.

In 2015 the most of beekeepers kept apiaries in the Małopolskie province (over 7 thousand) followed by Lubelskie (6.6 thousand), Podkarpackie (approx. 5.8 thousand), and Śląskie (5.7 thousand) provinces. For years the Podlaskie province (with about 1.5 thousand beekeepers), and Lubuskie, Opolskie and Pomorskie provinces with the number of beekeepers within the range of 2.1 thousand were the least interested in this kind of economic activity (Wilde 2016). Regarding the structure of apiaries, most of them comprised up to 20 bee colonies. According to the beekeeping organizations – the Polish

Association of Beekeeping - the natural aging of the beekeepers environment was observed in Poland for over two decades. Persons of old age and post-production age dominate among the Association members and from 2004 to 2015 their number even increased by 12.6% to totaling more than 65% of members. As regards the beekeepers over 50 years of age, in 2015 the producers from 51 to 65 (i.e. 35.5% of the total number) were a dominant subgroup, while those born before 1950 constituted approximately 30%.

Table 1. Estimated number of the beekeepers who were and were not members of the beekeeping organizations and the estimated number of bee colonies in Poland in the years 2004-2014

Specification	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014*
	The estimated number of the beekeepers										
Total	39894	36636	38536	40486	39018	38961	36453	38872	39504	39741	39500
United	29375	27104	29786	29480	27869	27758	28379	29470	30160	30907	-
Non-united	10519	9532	9750	11006	11149	11203	8074	9402	9344	8834	-
	The estimated number of bee colonies										
Total	93006	82741	84331	85994	85776	87007	87629	92218	93781	95442	138602
By united beekeepers	788582	702346	737376	722771	717061	711169	764368	793459	824789	835600	-
By non-united beekeepers	141484	125073	105943	137173	158703	158901	111926	128730	113023	118829	-

Source: Statistical Yearbook of Agriculture, CSO, Warsaw, 2010 Polish Association of Beekeepers <http://zwiazek-pszczelarski.pl/statystyki/> [Access: March 2016]; \*own calculation.

The beekeepers not exceeding 35 years of age were the least numerous and their share, in spite of the slow increase from 9% to 12%, still should be considered too low to guarantee the replacement of generations in that professional environment. The beekeepers between 36 and 50 years of age constituted slightly more than 1/4- 1/5 of the beekeepers age structure (Table 2). In 2015 Semkiw emphasized that the young beekeepers kept apiaries of mainly 11 to 20 hives, while the apiaries run by the middle-aged beekeepers (36 to 50) usually comprised from 11 to 50 colonies. The similar situation was observed in the group of older beekeepers (more than 50), while those over 65 years of age focused mainly on running the apiaries with 5 to 10 hives and from 11 to 20 colonies.

Table 2. Age structure of the beekeepers who are members of beekeeping organizations in Poland in 2004-2015, %

Years of the beekeepers	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2015
< 35	9,0	10,7	9,8	11,7	9,8	9,8	9,9	10,2	10,7	10,4	12,1
36-50	37,9	34,5	33,1	31	29,5	29,5	25,5	24,6	23,6	21,8	22,21
> 50	53,1	54,8	57,1	57,3	60,7	61,7	64,6	65,2	65,7	67,8	65,7

Source: Polish Association of Beekeepers <http://zwiazek-pszczelarski.pl/statystyki/> [Access: March 2016] data in the period 2009-2015 and in 2015 Semkiw P. Sektor pszczelarski w Polsce w 2015 r., Instytut Ogrodnictwa, Zakład Pszczelnictwa w Puławach, Puławy, 2015, 8.

The apiculture sector is an important part of the EU agriculture. The total number of beekeepers was estimated at 630 000 and 16 million of hives in the EU, producing 234.000 tons of honey per year<sup>2</sup>. According to Eurostat data, 59% of beekeepers are over 55 years

<sup>2</sup> [http://ec.europa.eu/food/animals/live\\_animals/bees/health/index\\_en.htm](http://ec.europa.eu/food/animals/live_animals/bees/health/index_en.htm)(20.09.2016)

old in the EU, and only 5.5% of them are younger than 35; 34.5% are between 35-54 years old. Thus, the EU is having the same problem as Poland as regards beekeeper generation replacement. Moreover, having regard to the definition of a professional beekeeper, i.e. a person who owns more than 150 hives, it can be concluded that beekeeping industry exists due to non-professional beekeepers. Around 95% of beekeepers are non-professionals; they keep approximately 60% of the EU hives. However, most of the non-professionals depend on beekeeping for living while the economic incentive and profit is not usually the primary interest of hobbyist beekeepers<sup>3</sup>. Moreover, 80% of bee keeping farmers manage an agricultural area which does not exceed 10 ha.

Table 3. Bee colonies in selected EU Member States in the period 2000-2013, in 1000 beehives

Year/Country	2000	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2013 2000=100
Austria	310	283	281	275	298	300	330	368	368	376	382	124
Belgium	29	29	29	29	30	30	30	30	31	32	32	108
Bulgaria	335	410	450	672	715	719	653	613	548	529	542	164
Cyprus	44	40	40	40	45	40	35	40	38	38	39	92
Czech Rep.	535	557	552	526	520	461	498	528	565	541	533	103
Estonia	23	35	33	33	38	30	25	28	26	41	39	192
Finland	42	46	53	54	53	43	41	37	37	38	43	112
France	1150	1000	1000	977	1014	1000	884	840	820	795	789	64
Germany	902	930	930	940	900	692	695	685	695	699	700	78
Greece	1290	1302	1314	1333	1343	1340	1340	1340	1340	1340	1340	104
Hungary	590	612	658	641	493	553	421	432	610	729	678	130
Italy	900	900	950	930	940	500	500	500	500	500	500	58
Lithuania	73	81	83	85	88	101	102	103	94	90	88	121
Luxembourg	9	11	11	10	8	8	6	5	5	4	4	16
Poland	1300	1300	1250	1400	1450	1450	1450	1450	1465	1470	1500	115
Portugal	298	300	300	305	320	310	320	325	330	330	332	111
Romania	614	840	888	888	891	982	998	1057	1275	1295	1254	176
Slovakia	279	192	237	277	246	248	216	232	240	257	255	101
Slovenia	190	100	90	40	40	41	46	52	60	63	63	23
Spain	2125	2397	2338	2345	2313	2389	2390	2439	2440	2429	2430	114
Sweden	53	54	54	50	50	50	45	46	48	48	48	92
World	70708	74089	75327	76183	75129	75967	76188	78078	78566	80516	81056	114

Source: FAOSTAT 2016.

The greatest number of bee colonies in the EU is recorded in Spain (over 2.4 million), followed by Poland (approx. 1.5 million), Greece (1.3 million) and Romania (1.25 million). In the period 2000-2013 those four countries accounted for approx. 50-56% of all bee colonies in the EU (Table 3). Although the global increase in the number of bee colonies in the period under consideration reached 14% on average, particular EU Member States recorded various results. An increase by a few per cent was recorded in Belgium, the Czech Republic or Greece, more than 10% increases were recorded in Finland, Poland, Portugal and Spain, and the greatest increases were noted in Hungary (by 30%), Bulgaria (by 64%),

<sup>3</sup> Evaluation of the CAP measures related to apiculture Agriculture and Rural Development DG -Final Report [http://ec.europa.eu/agriculture/evaluation/market-and-income-reports/2013/apiculture/chap3\\_en.pdf](http://ec.europa.eu/agriculture/evaluation/market-and-income-reports/2013/apiculture/chap3_en.pdf).

Romania (by 76%) and Estonia (by 92%). A reverse trend was noticed in France (decrease of the number of beehives by the average of 36%), Italy (by 42%), Luxembourg (by 84%), Slovenia (by 77%), Germany (by 22%), Cyprus and Sweden (by 8%) (Table 3). The reasons for decrease include environmental changes or pathogens. Each EU beekeeper held an average of 23 colonies but Spanish beekeepers had the highest average number of colonies (103/per beekeeper) whereas British beekeepers owned the smallest average number of colonies (only 5<sup>4</sup>); at the same time, the average number of colonies in Poland was approx. 23-25.

In the years 2011 to 2015 the number of bee colonies in Poland increased by 29% from approximately 1.1 million to over 1.44 million. The majority of bee colonies were noted in the Lubelskie, Warmińsko-Mazurskie, Podkarpackie, Małopolskie, and Wielkopolskie provinces (48.2% of the total number of colonies), while their lowest number was recorded in the Podlaskie, Opolskie, Lubuskie and Pomorskie provinces (12.3% of the total number of colonies). The review of particular provinces showed the growth of number of hives in the Śląskie province (66.4%), Lubelskie province (44%) and the Zachodniopomorskie, Świętokrzyskie and Łódzkie provinces where the growth of more than 30% to 37% was noted (Table 4).

Table 4. Number and structure of bee colonies in Poland in 2011-2015 by province

Provinces	Number of bee colonies previous year = 100						The structure of bee colonies				
	2011	2012	2013	2014	2015	2011- 2015	2011	2012	2013	2014	2015
Dolnośląskie (A)	100	114,4	105,9	100,3	105,1	127,6	7,5	7,6	7,6	7,4	7,5
Kujawsko-pomorskie (B)	100	111,1	105,2	101,5	103,1	122,2	5,1	4,9	5,0	4,9	4,8
Lubelskie (C)	100	126,3	103,9	104,1	105,4	143,9	11,5	12,8	12,6	12,8	12,9
Lubuskie (D)	100	111,8	105,0	102,7	95,8	115,4	3,7	3,6	3,6	3,6	3,3
Łódzkie (E)	100	104,4	116,0	101,9	111,1	137,3	4,2	3,9	4,3	4,2	4,5
Małopolskie (F)	100	107,0	102,0	104,9	103,7	118,8	9,5	8,9	8,6	8,8	8,7
Mazowieckie (G)	100	112,4	101,3	100,8	112,5	129,2	7,5	7,4	7,1	7,0	7,5
Opolskie (H)	100	107,1	115,7	107,3	96,8	128,8	2,7	2,6	2,8	3,0	2,7
Podkarpackie (I)	100	111,0	104,5	102,8	102,1	121,9	9,8	9,6	9,5	9,5	9,3
Podlaskie (K)	100	107,9	106,1	100,0	107,9	123,2	2,7	2,5	2,6	2,5	2,6
Pomorskie (L)	100	113,5	101,4	105,1	100,6	121,7	4,0	3,9	3,8	3,9	3,7
Śląskie (M)	100	147,2	103,6	99,7	109,5	166,4	3,9	5,0	5,0	4,8	5,0
Świętokrzyskie (N)	100	114,9	105,6	103,9	106,7	134,5	4,3	4,3	4,4	4,4	4,5
Warmińsko-mazurskie (O)	100	116,1	101,1	104,0	105,1	128,3	9,5	9,7	9,3	9,4	9,4
Wielkopolskie (P)	100	106,4	108,9	104,5	99,1	119,9	8,5	8,0	8,3	8,4	7,9
Zachodniopomorskie (R)	100	109,8	107,4	104,8	105,2	130,0	5,6	5,3	5,5	5,6	5,6
	Number of bee colonies (1000)										
Poland (T)	1123	1280	1344	1386	1448	129	100	100	100	100	100

Source: Analiza sektora pszczelarskiego w Polsce, Instytut Sadownictwa i Kwiaciarnictwa Oddział Pszczelnictwa w Puławach, for the period 2010-2015.

The number of bee colonies in an average apiary in the country dropped (decrease of approx. 7.6%) in the assessed period of time. In 2015 there were 23.1 hives in an average

<sup>4</sup> No data available for UK, Finland, Denmark, Germany, Ireland, Malta, The Netherlands, Austria, Sweden

apiary i.e. the same number as in 2004. While in most provinces, a decrease of an average apiary size was recorded with drop of 20.8 % in the Pomorskie province above all, in the case of the Dolnośląskie province an increase of 16%, and in the Lubelskie and Śląskie provinces a small increase of 6% were recorded. The largest apiaries were located in the north-eastern Poland, i.e. the Warmińsko-Mazurskie province (with 40.7 bee colonies), and the north-western Poland, i.e. the Zachodniopomorskie (30.2), Dolnośląskie (28.9), and Lubelskie (28.1) provinces. The smallest apiaries with an average of about 13 bee colonies were noted in the Śląsk region. In 2015 the beehive stock comparable to the national average was recorded in the Podlaskie, Podkarpackie, and Lubuskie provinces (Table 5).

Table 5. Average size of an apiary in Poland and density of honeybee colonies (number of colonies per 2 km sq.) in 2010-2015 by province

Provinces/years	Average size of an apiary					Density of honeybee colonies (no. of colonies per 2 km sq.)					
	2010	2012	2013	2014	2015	2010	2012	2013	2014	2015	2010 - 2015
Dolnośląskie (A)	24,9	27,7	28,4	28,3	28,9	4,3	4,9	5,1	5,2	5,4	127
Kujawsko-pomorskie (B)	27,5	26,1	25,8	25,5	24,3	3,2	3,5	3,7	3,8	3,9	123
Lubelskie (C)	26,3	29,5	29,2	28,5	28,1	5,2	6,5	6,8	7,0	7,4	143
Lubuskie (D)	26,6	26,9	26,4	25,7	23,0	3,0	3,3	3,5	3,6	3,4	115
Łódzkie (E)	19,5	19,2	18,5	18,3	17,7	2,6	2,7	3,2	3,2	3,6	139
Małopolskie (F)	19,8	19,4	18,8	18,3	17,8	7,0	7,5	7,6	8,0	8,3	119
Mazowieckie (G)	22,9	22,0	21,8	22,0	20,7	2,4	2,7	2,7	2,7	3,1	131
Opolskie (H)	22,6	20,1	20,6	20,0	18,6	3,3	3,5	4,1	4,4	4,2	128
Podkarpackie (I)	25,9	24,7	24,4	24,0	23,2	6,2	6,9	7,2	7,4	7,5	121
Podlaskie (K)	26,2	25,1	26,0	24,8	23,6	1,5	1,6	1,7	1,7	1,8	120
Pomorskie (L)	31,2	28,9	27,9	27,6	24,7	2,4	2,8	2,8	2,9	3,0	124
Śląskie (M)	11,9	13,1	13,2	13,3	12,7	3,5	5,2	5,4	5,4	5,9	167
Świętokrzyskie (N)	29,3	27,3	26,7	25,6	24,6	4,1	4,7	5,0	5,2	5,5	133
Warmińsko-mazurskie (O)	45,2	44,2	42,7	41,3	40,7	4,4	5,1	5,2	5,4	5,7	129
Wielkopolskie (P)	25,5	24,2	24,1	23,6	22,2	3,3	3,4	3,7	3,9	3,9	119
Zachodniopomorskie (R)	32,7	30,5	31,0	30,2	30,2	2,7	3,0	3,2	3,4	3,5	128
<b>Poland (T)</b>	<b>25,0</b>	<b>24,7</b>	<b>24,4</b>	<b>24,1</b>	<b>23,1</b>	<b>3,7</b>	<b>4,1</b>	<b>4,3</b>	<b>4,4</b>	<b>4,6</b>	<b>125</b>

Source: own calculation and Analiza sektora pszczelarskiego w Polsce, Instytut Sadownictwa i Kwiaciarnictwa Oddział Pszczelnictwa w Puławach, for the period 2010-2015.

The considerable fragmentation is characteristic for the Polish beekeeping. The assessment of structure of the beekeepers in relation to the structure of their apiaries indicated that more than a half of them (50.6%) run small apiaries ranging in size from 6 to 20 hives and only 16.4% had less than 5 colonies. In 2010-2015 the number of colonies in both those groups totalled approximately 30.5% (i.e. a little over 442 thousand) (Table 6).

It could be assumed that they were typical amateur apiaries. Nearly 20% of the beekeepers owned medium-sized apiaries with 21 to 50 hives. In the Lublin, Zachodniopomorskie, and Warmińsko-Mazurskie provinces such medium-sized apiaries accounted for 30% - 35%. Over the last six years about 6.5% - 7% of the beekeepers run the beekeeping farms with 51 to 80 hives and 2.2% run the commercial apiaries with more than 80 hives which constituted 13.7% of the total number. It is worth mentioning in this



place that in Poland the apiaries not exceeding 80 colonies are not subject to mandatory registration in a respective agricultural production sector, and for that reason in their case no taxes are applicable (such as 3,56 PLN /hive income tax in 2015). Therefore it is not surprising that the beekeepers (especially those who run small apiaries in own backyards as a hobby or on a slightly larger scale only) are interested in running apiaries not exceeding the statutory limit and, what is more, some of them register their apiaries formally as the, so called, small or medium-sized apiary (and thus divide the colonies into bee colony members)<sup>5</sup>.

Table 6. The structure of beekeepers and bee colonies in relation to the structure of apiaries in Poland in 2015 by province

Provinces/ hives	The structure of beekeepers in relation to the structure of apiaries									The structure of bee colonies								
	Total	to 5 hives	6-10 hives	11-20 hives	21-50 hives	51-80 hives	81-150 hives	151-300 hives	>301 hives	No. of bee colonies	to 5 hives	6-10 hives	11-20 hives	21-50 hives	51-80 hives	81-150 hives	151-300 hives	>301 hives
A	<b>6,0</b>	11,8	21,0	27,1	28,0	7,9	2,8	0,9	0,5	<b>7,5</b>	1,6	6,5	15,8	33,5	18,5	10,6	6,5	7,0
B	<b>4,6</b>	13,6	22,2	26,6	28,6	6,7	1,8	0,4	0,0	<b>4,8</b>	1,8	8,0	18,5	41,2	18,5	8,1	3,2	0,6
C	<b>10,6</b>	8,4	21,6	27,6	30,3	9,8	1,8	0,5	0,1	<b>12,9</b>	1,1	6,9	16,7	38,2	24,7	7,0	4,0	1,4
D	<b>3,3</b>	15,2	22,1	24,7	28,8	7,3	1,4	0,2	0,2	<b>3,3</b>	1,9	7,6	16,7	40,2	20,1	6,4	1,8	5,4
E	<b>5,9</b>	17,3	29,1	29,7	20,2	3,1	0,4	0,2	0,0	<b>4,5</b>	4,1	14,8	28,1	36,9	11,4	2,4	1,7	0,6
F	<b>11,3</b>	22,2	31,3	23,9	18,2	3,3	0,7	0,2	0,1	<b>8,7</b>	4,9	15,3	22,2	34,6	12,8	4,5	2,6	3,0
G	<b>8,4</b>	15,3	27,7	27,5	22,9	5,0	1,2	0,3	0,0	<b>7,5</b>	2,7	11,4	22,0	37,7	16,6	6,1	2,9	0,7
H	<b>3,4</b>	23,9	27,2	25,0	17,4	5,2	1,0	0,1	0,1	<b>2,7</b>	3,8	12,7	21,9	32,0	19,3	6,1	1,4	2,8
I	<b>9,3</b>	11,2	25,8	29,5	25,1	6,5	1,5	0,4	0,0	<b>9,3</b>	1,8	10,0	21,3	37,3	19,3	6,9	3,1	0,3
K	<b>2,5</b>	11,8	23,8	27,3	29,8	5,4	1,6	0,3	0,0	<b>2,6</b>	1,8	9,0	19,5	43,9	15,4	7,7	2,7	0,0
L	<b>3,5</b>	20,0	19,2	23,7	28,0	6,7	1,5	0,7	0,3	<b>3,7</b>	1,6	6,9	16,4	39,5	18,6	6,3	5,6	5,0
M	<b>9,1</b>	33,4	30,5	22,3	11,7	1,6	0,3	0,1	0,0	<b>5,0</b>	9,1	20,1	28,6	29,5	8,5	2,6	1,6	0,0
N	<b>4,2</b>	14,0	25,3	26,2	24,1	7,8	2,2	0,3	0,1	<b>4,5</b>	1,9	9,2	17,8	35,2	22,0	9,8	2,3	1,7
O	<b>5,4</b>	4,7	13,8	22,7	35,1	16,6	5,4	1,3	0,4	<b>9,4</b>	0,5	3,1	9,7	31,4	28,6	13,7	6,4	6,7
P	<b>8,3</b>	20,8	23,0	24,2	23,1	6,4	1,9	0,4	0,1	<b>7,9</b>	2,8	9,2	18,3	35,5	19,9	8,8	4,3	1,0
R	<b>4,3</b>	9,8	17,9	24,2	33,9	10,6	2,9	0,5	0,1	<b>5,6</b>	1,2	5,3	13,6	40,9	23,7	10,5	3,3	1,5
<b>T</b>	<b>100</b>	<b>16,4</b>	<b>24,7</b>	<b>25,8</b>	<b>24,3</b>	<b>6,6</b>	<b>1,6</b>	<b>0,4</b>	<b>0,1</b>	<b>100</b>	<b>2,5</b>	<b>9,4</b>	<b>18,7</b>	<b>36,3</b>	<b>19,4</b>	<b>7,6</b>	<b>3,7</b>	<b>2,4</b>

Source: own calculation and Semkiw P. (2015). Analiza sektora pszczelarskiego w Polsce, Instytut Sadownictwa i Kwiaciarnictwa Oddział Pszczelnictwa w Puławach, 5-7.

A commercial apiary, as defined in European Commission Regulation (EC) No 917/2004, must comprise more than 150 hives. Such apiaries, if only because of their scale and specialization, operate as specialized beekeeping farms in which the economic efficiency of operation and even the total production volume stem from their focus on increase of honey yield and better quality of honey offered on the market. The quality of honey is a result of many factors, both dependent and independent of a beekeeper, and seasonal variables that though cannot be predicted are likely to ultimately have effect on the

<sup>5</sup> Data provided by the Research Institute of Pomology and Floriculture, Division of Apiculture in Puławy

product. Such factors include the intensity of presence or absence of honey flows, weather conditions, and human factors such as knowledge, experience, competence, skills in running the apiary business (inclusive of types and procedures of application of medicines, harvesting honey from each honey flow i.e. the production of honey varieties, honey extraction from supers and frames, moment of harvesting - honey maturity), technical and sanitary conditions of harvest, as well as processing of harvested honey (i.e. the way honey is processed, quality of collective packaging, conditions of storage, preparation for sale, packaging for retail - unit packaging, etc.).

Regardless of the scale of activity of a beekeeping farm, more and more beekeepers are convinced that honey of attractive taste, flavour, delicate texture, and high quality will attract target consumers, which has been proved in practice by the producers of regional honeys in Poland. The growing interest of consumers in the natural products, including the ecological regional honeys, led to the gradual increase of percentage of the apiaries with more than 80 hives, including those run by professional beekeepers. In the years 2011 to 2015 the number of professional beekeepers increased by 5.5% i.e. 17 persons to 324 in the whole country, and the number of bee colonies in such commercial beekeeping farms grew by 7.4% (by nearly 7 thousand i.e. a total of over 88 thousand colonies).

It is worth noting that about 75% of the beekeepers in the Łódzkie, Małopolskie, Mazowieckie and Opolskie provinces run the apiaries with up to 20 hives. The percentage of such apiaries accounted for 86% in the Śląsk region, while in the Warmińsko-Mazurskie province there were 41% such apiaries. That latter region with the largest number of professional apiaries run by more than 7% of the beekeepers operating there stood out from the other provinces. In the whole country scale the professional apiaries constitute 20.3% of over 88 thousand apiaries with more than 150 bee colonies, i.e. 17.9 thousand hives run by 56 professional beekeepers.

An uneven distribution of bee colonies, i.e. the number of bee colonies per 1 km sq., is characteristic for Poland. The above results from, among others, availability and condition of honey flows, their diversity, local climatic conditions, profitability of the beekeeping business in a given area, traditions of honeybee breeding and rearing (Borowska 2010a, 2010b). An appropriate number of bee colonies in a given region is a condition for maintaining the, so-called, biodiversity in nature and facilitate proper pollination of the entomophilous crops. Unfortunately, the situation in some provinces is not always good which translates into unsatisfactory pollination of the entomophilous plants of the agriculture and pomology sector. In Poland the diversity in number of colonies per 1 km sq. is still considerable. In the years 2010 to 2015 the average density increased by 25% from 3.7 to 4.6 colonies per 1 km sq. (Table 5).

For years the highest density of colonies (8.3 hives), understood as a large number of colonies on a small acreage, was recorded in the south - eastern and north - eastern regions of Poland, especially in the Małopolskie province, while the lowest density of colonies was noted in the Podlasie region, central Poland (the Mazowieckie province), Pomorze, and western part of Poland (1.8, 3.1, and 3 hives, respectively). According to the estimates of Apiculture Division in Puławy, about 3 colonies per 1 km sq. is considered optimal. However, despite the growing number of pollinators in the last decade, the research conducted by Majewski 2010 indicated that was still inadequate in view of the growing demand for pollination in Poland.

In most provinces the density of colonies was insufficient to even minimally pollinate the crops. The shortage of colonies in Poland was estimated at over 1.5 million in total. The

Małopolskie province was an exception. Taking into account the economic impact of that problem in Poland, in 2007 the annual benefit from pollination of rape only was within the range of 600 million PLN (Semkiw, Ochał, 2010) to 700 million was recorded (Semkiw, 2007). In the case of fruit crops the respective figure was over PLN 3 billion. About 33,3% of the agriculture production was achieved thank to the pollination by insects whereas the losses in the Polish economy in resulting from the shortage of bee colonies were estimated at about 2.5 to 3 billion (Semkiw, Gerula, Węgrzynowicz, 2007). Of course, similarly to other regions, also in Poland the annual losses in bee colonies was an important issue. Until recently, the losses occurred usually during wintering and the extent of losses was determined during the first inspection of hives at early spring. The losses were rated typically at a few percent. In the recent years however (2010 to 2015) the intensifying phenomenon of mass deaths of bees after wintering (assessed in spring) amounting to even 11% to 18% of the colonies was observed.

Table 7. Number of professional beekeepers, number of bee colonies in professional apiaries, and average size of a professional apiary in Poland in 2009 - 2015 by province

Province	Number of professional beekeepers					Number of bee colonies in professional apiaries (1000)					Average size of a professional apiary				
	2009	2012	2013	2014	2015	2009	2012	2013	2014	2015	2009	2012	2013	2014	2015
A	13	36	38	49	51	2,5	8,6	9,8	12,4	14,6	193,5	239,7	259,1	253,9	287,1
B	10	11	10	12	12	2,3	2,4	2,5	2,6	2,6	236,5	221,4	224,5	217,8	220,8
C	29	35	38	37	39	7,1	8,9	9,9	9,6	10,1	243,3	255,6	260,9	260,0	258,8
D	7	7	8	8	8	3,3	3,3	3,4	3,4	3,4	465,7	465,7	430,0	430,0	430,0
E	7	10	11	10	7	1,4	1,9	2,1	1,9	1,5	203,7	189,7	192,5	189,7	208,4
F	17	21	20	21	21	5,2	6,9	6,8	7,1	7,1	307,6	332,3	338,9	337,7	337,7
G	15	18	18	20	17	3,6	4,1	4,0	4,5	3,9	239,3	228,6	224,2	223,0	231,7
H	7	4	5	5	5	1,7	1,2	1,4	1,6	1,6	254,3	310,0	284,0	330,0	330,0
I	20	24	26	26	22	4,3	5,3	5,6	5,5	4,6	216,3	220,0	216,1	212,3	208,1
K	7	6	6	6	5	1,2	1,3	1,3	1,3	1,0	175,7	218,3	218,3	218,3	202,0
L	14	23	22	20	22	4,8	7,3	6,1	5,2	5,7	348,6	317,0	276,8	261,5	261,4
M	3	7	6	7	6	0,5	1,4	1,2	1,3	1,2	180,0	201,4	198,3	191,7	198,3
N	9	9	9	9	10	2,2	2,2	2,2	2,2	2,6	250,0	250,0	250,0	250,0	261,0
O	42	61	61	59	56	10,7	18,5	17,9	16,7	17,9	256,2	304,1	293,9	283,2	319,9
P	23	23	26	28	26	5,6	5,6	6,5	6,8	6,2	242,3	246,8	252,0	243,1	238,0
R	14	12	12	13	17	2,9	2,7	2,5	2,6	3,8	212,1	225,0	213,3	204,5	226,6
T	<b>237</b>	<b>307</b>	<b>316</b>	<b>330</b>	<b>324</b>	<b>59,7</b>	<b>81,9</b>	<b>83,3</b>	<b>85,0</b>	<b>88,0</b>	<b>252,1</b>	<b>267,0</b>	<b>263,6</b>	<b>257,7</b>	<b>271,8</b>

Source: own calculation and Semkiw P. Analiza sektora pszczelarskiego w Polsce, Instytut Sadownictwa i Kwiaciarnictwa Oddział Pszczelnictwa w Puławach, for the period 2009-2015.

Until recently, the sporadic incidences of deaths, poisoning, intoxications, or significant weakening of the colonies in the beekeeping season resulted from improper agricultural treatment (especially chemical, e.g. the plant protection products applied at a wrong time of day), especially in case of the plantations of rape (winter or spring) and fruit crops, although there were cases of intoxications in the crops of tobacco, potatoes, corn, mustard, berry bushes, phacelia, buckwheat, and others. In 2012-2015 beekeeping season less losses caused by both, the acute poisoning and intoxication, were suffered and dropped from, respectively, over 3 thousand and 14.3 thousand to about 1.1 thousand and 2.8 thousand colonies. It should be assumed that it was a consequence of better farmers' knowledge of damage to bee colonies they could cause, training in the proper use of plant protection products, and cooperation with the beekeepers including inter alia the

dissemination of information on migratory hives in the region (for instance their presence in orchards, oilseed rape cultivation sites, etc.), as well as heavy fines and possible cancellation of agricultural production subsidies under RDP (Rural Development Programme) imposed on parties found guilty of damage.

In the years 2009-2015 the number of professional beekeepers increased by 36.7% up to 324 entities running more than 88 thousand bee colonies. The most of professional apiaries were established in the two provinces: Warmińsko-Mazurskie and Dolnośląskie. An almost three-fold increase was reported in the first province and growth by 33,3% in the second one which constituted over 56% of the total number of the professional beekeepers in the country. In two provinces however, namely Opolskie and Podlaskie, several professional beekeepers withdrew from the honey production business. The lowest number of professional beekeepers (5 to 7) were noted in the Opolskie, Podlaskie, Śląskie and Łódzkie provinces. At the beginning of the assessed period 78.5% of the professional apiaries had 150 to 300 hives, the remaining number of hives belonged to 68 beekeepers running the beekeeping farms with more than 300 colonies, whereas in 2015 a change of the professional beekeepers structure, consisting in 40% growth in the number of the largest apiaries with more than 300 hives, was noted (Table 7).

Table 8. Number of beekeepers in relation to the structure of apiaries and number of bee colonies in professional apiaries (of over 151 hives) in Poland in 2015 by province

Province	Number of beekeepers in relation to the structure of apiaries			Number of bee colonies in professional apiaries (of over 151 hives)					
	151-300 hives	>301 hives	Total	151-300 hives	> 301 hives	Total	Structure (%) in total		
							15-300 hives	>301 hives	
A	34	17	51	7028	7612	14640	16,6	48	52
B	11	1	12	2220	430	2650	3,0	84	16
C	34	5	39	7432	2663	10095	11,5	74	26
D	4	4	8	840	2600	3440	3,9	24	76
E	6	1	7	1087	372	1459	1,7	75	25
F	15	6	21	3282	3810	7092	8,1	46	54
G	15	2	17	3159	780	3939	4,5	80	20
H	3	2	5	550	1100	1650	1,9	33	67
I	21	1	22	4229	350	4579	5,2	92	8
K	5	0	5	1010	0	1010	1,1	100	0
L	15	7	22	3040	2710	5750	6,5	53	47
M	6	0	6	1190	0	1190	1,4	100	0
N	7	3	10	1520	1090	2610	3,0	58	42
O	42	14	56	8692	9220	17912	20,3	49	51
P	23	3	26	4987	1200	6187	7,0	81	19
R	14	3	17	2668	1184	3852	4,4	69	31
<b>T</b>	<b>255</b>	<b>69</b>	<b>324</b>	<b>52934</b>	<b>35121</b>	<b>88055</b>	<b>100</b>	<b>60</b>	<b>40</b>

Source: own calculation and Semkiw P. Analiza sektora pszczelarskiego w Polsce, Instytut Sadownictwa i Kwiaciarnictwa Oddział Pszczelnictwa w Puławach, for the period 2009-2015.

In 2015 an average apiary in Poland comprised about 23 colonies, while the average professional apiary 272 colonies. The smallest average apiaries run by professional beekeepers were located in the Śląskie and Podlaskie provinces (with 189 and 202 hives,

respectively), and the largest ones in the Lubuskie, Małopolskie, and Opolskie provinces (with 430, 338, and 330 hives, respectively). The difference between the minimum and maximum extremes reached 241 hives. The highest percentage of about 13 % of colonies in the professional apiaries in relation to the total number of colonies was reported in the Warmińsko - Mazurskie and Dolnośląskie provinces, the lowest number in the Śląskie (1.6%), Łódzkie (2.2%), and Podlaskie (2.7%) provinces. The respective country average was 6.1%. In Poland, the relation of number of the professional beekeepers to the other ones is very small (0.6 %), while in the other EU countries the respective average relation stands at around 3.5 %, and in Greece (Bee Mortality 2008, The honey... 2009) and Spain over 33,3% and 25% (Borowska 2011b, Semkiw 2007, 2010). The fragmentation of apiaries in Poland is a factor that has direct impact on the low profitability of production, while the associated high costs, small scale of production, and lack of investment capital, significantly reduce the economic results and hinder further development. For those reasons the structure of apiaries in Poland did not changed substantially in the recent years.

The activities undertaken within the framework of the successive National Apiculture Support Programmes were, and still are, directed at the development of beekeeping, preserving the colonies volume, and enhancing the quality of products offered on the market, inclusive of honey. In view of nature of this sector of economy and its changes the following issues are considered important: raising the level of beekeeping knowledge among the beginners and persons already engaged in the beekeeping, provision of support in the modernization of beekeeping farms (through purchase of professional beekeeping equipment), support to the laboratories carrying out physical and chemical analyzes of honey, mitigation of problems associated with combating the diseases of bee colonies inclusive of varroa, supporting the activities contributing to restocking of hives, rationalization of the seasonal movements of hives, and cooperation in the scientific and research programs. The new program also supports the research of commercial quality of honey and exploration and identification of honey varieties on the market. So far, the beekeepers were supported under the three-year "National Beekeeping Support Programme in Poland" (NBSP) accepted by the European Commission. In the years 2004-2016 four NBSP programmes<sup>6</sup> with total budget amounting to more than EUR 66.56 million were implemented in Poland (National Beekeeping Support Programmes 2007-10 and 2016-19, Borowska, 2013). It is worth mentioning that in the years 2014-16 Poland was granted 8.3%<sup>7</sup> of the total EU-28 budget (EUR 99.3 million) allocated for financial support of the beekeeping taking the fifth place after Spain (16%), France (10.7%), Romania (10.1%), and Italy (8.6%).

## Conclusions

Basing on changes of the beekeeping sector in Poland in the years 2010-2015 the following conclusions can be drawn:

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<sup>6</sup> The budget of 1st NBSP in the years 2004/05-2006/2007 was EUR 11.7 M, 2nd NBSP in 2007/2008-2009/10 - EUR 13.3 M, 3rd NBSP in 2010/2011-2012/2013 - EUR 15.1 M, 4th NBSP in 2013/2014-2015/2016 - EUR 26.46 M, and the planned budget of 4<sup>th</sup> NBSP = over EUR 18.22 M.

<sup>7</sup> EU funding for Apiculture Programmes 2014-2016 (in €) [http://ec.europa.eu/agriculture/newsroom/121\\_en.htm](http://ec.europa.eu/agriculture/newsroom/121_en.htm) [Access March 2016].

1. The proportion of the beekeepers who do not belong to any professional organization in the total number of the country's beekeepers decreases. Besides, the number of professional beekeepers systematically and gradually increases (by over 1/3 in the examined period), although their number of 324 entities keeping over 88 thousand bee colonies is still one of the lowest in the EU. People of mature age and retirement age dominate among the beekeepers (65%).
2. Considerable fragmentation and apiaries often run by amateurs are characteristic for the beekeeping in Poland. In 2015 an average apiary in the country had 23 colonies, while a professional apiary comprised 272 hives. More than half of the beekeeping farms had from 6 to 20 hives and as much as 16.4 % did not exceed 5 colonies. Only 2.2% of the beekeepers run the commercial apiaries with more than 80 bee colonies which constituted 13.7% of their total number.
3. Although 29% increase in the number of colonies up to more than 1.44 million was recorded in the reporting period, the number of hives in an average apiary gradually decreased (about 23 hives in 2015 – a drop of nearly 8%).

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