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1, 9700
2, 1373

Effect of Different Sources of Specific Variance on Fertility of Ile-de-France Sheep in Bulgaria

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SUMMARY

1115 Subject of the study were 1115
- purebred sheep from the Ile-de-France
2008-2016 - breed. The animals were born during the
period 2008-2016 and were raised under
similar technological conditions and
nutrition in three farms in the northern part
e - of Bulgaria. The biological prolificacy,
, demonstrated here in Bulgaria, were
studied. 2413 observations of the
2413 - biological prolificacy trait from first to fifth
lambing of ewes were recorded.
-
, The information was derived from the
- Genealogy Book kept by the Breeders of
the Ile-de-France Breeders Association in
(). Bulgaria (AILFB). Data were obtained
using standard methods and instructions,
, provided in the Instruction Codex for
- Control of Productive Traits and Complex
- Evaluation, which is part of a selection
program for breed development in

Student (Hayter, 1984).

4
(1.771
5-
(1.760

(1.529

).

50-60 %
(Stancheva
and Staykova, 2009), 52.13%
69.34% (Staykova, 2005)
70%
(Boykovski et al., 2006).

Bulgaria. Analysis of variance was conducted on the basis of multi-factor linear models. The differences between the levels of the studied factors were established on the basis of the degree of probability by Student (Hayter, 1984).

It was established that the age of animals and the farm, as sources of specific variance, have a significant effect on the biological prolificacy of Ile-de-France sheep raised in Bulgaria. Year of birth does not affect the studied trait.

Ewes at 4 years of age demonstrated the highest fertility (1.771 lambs per ewe), followed by the 5 year-old animals (1.760 lambs per ewe). The results displayed the high potential for selection by this trait.

The lowest results were at first lambing (1.529 lambs per ewe).

Key words: Ile-de-France sheep, biological prolificacy, age, farm, year of birth

INTRODUCTION

Organic fertility and the production of a greater number of weaned lambs determine to a great extent the profitability of production in modern-day sheep farms. Meat is one of the main products, forming 50-60% of the total revenue in the milk sector in our country (Stancheva and Staykova, 2009), from 52.13% to 69.34% in the Aboriginal (Staykova, 2005) and over 70% in fine-wool sheep production (Boykovski et al., 2006).

Lamb production is the main source of income, in the specialized meat industry, where milking is not practiced. One of the main problems in domestic sheep breeding in recent years has been the lack of manpower. The deepening of the problem leads to a trend towards orientation towards meat production.

The Ile de France breed enjoys growing

() 65-70%

50

Dimitrov et al., (1987);
Dimitrov, (1991); Laleva, (1996); Metodiev
et al., (2008, 2010).

6 543

170-180%.

2008-2016

2413

interest among farmers in Bulgaria. In France, its place of origin, there is a shortage of meat lambs (heavy lambs), along with other meat breeds, and 65-70% of the lamb carcasses are imported from Australia, the United Kingdom and other countries. The interest of Turkish and European companies is further enhanced by the fact that Bulgaria is an ecologically clean country close to major markets and transport links with the Middle East and Europe.

The favorable prospects and the increased interest in the breed in our country determine the need for current studies on fertility and the factors that influence the production of the Ile de France breed adapted to us for 50 years.

The reproductive abilities of the breed are studied by Dimitrov et al., (1987); Dimitrov, (1991); Laleva, (1996); Metodiev et al., (2008, 2010). According to data of the Ile de France Breeding Association in Bulgaria (AILFB), there are 6,543 pure-breed animals of the breed, with an average fertility rate of 170-180%.

The aim of the study is to establish the effect of different sources of specific variance on the biological prolificacy of Ile de France sheep.

MATERIAL AND METHODS

1115

Subject of the study were 1115 purebred sheep from the Ile-de-France breed. The animals were born during the period 2008-2016 and were raised under similar technological conditions and nutrition in three farms in the northern part of Bulgaria. The biological prolificacy, demonstrated here in Bulgaria, were studied. 2413 observations of the biological prolificacy trait from first to fifth lambing of ewes were recorded.

The information was derived from the Genealogy Book kept by the Breeders of

() .

(Harvey, 1990),

$$Y_{ijklm} = \mu + A_{ijklmno} + B_{pqhij} + rstij + e_{ijklm}$$

μ -

$A_{ijklmno}$ - () - 9 (2008-2016)

B_{pqhij} - () - 5 (2 - 6)

$rstij$ - () - 3 (1 - 3)

e_{ijklm} - (residual effects), $N(O, e^2)$

Student (Hayter, 1984):

$$(y_i - y_j) / S (1/n_i + 1/n_j) / 2$$

$$: (y_i - y_j) - ,$$

n_i , n_j - ()

- the Ile-de-France Breeders Association in Bulgaria (AILFB). Data were obtained
- using standard methods and instructions,
- provided in the Instruction Codex for
- Control of Productive Traits and Complex
- Evaluation, which is part of a selection
- program for breed development in
- Bulgaria. Analysis of variance was
- conducted on the basis of multi-factor
- linear models (Harvey, 1990). It has the
- following outlook:

Where:

μ - total average for all ages

$A_{ijklmno}$ - Effect of "year of birth" factor (fixed) - 9 levels (2008-2016)

B_{pqhij} - Effect of "age" factor (fixed) - 5 levels (2 - 6 years)

$rstij$ - Effect of "farm" factor (fixed) - 3 levels (1 - 3 farms)

e_{ijklm} - residual effects $N(O, e^2)$

The differences between the levels of the factors studied were established on the basis of the degree of probability measured by Student (Hayter, 1984):

$$(y_i - y_j) / S (1/n_i + 1/n_j) / 2$$

- where: $(y_i - y_j)$ is the differences between
- average values of levels from the studied
- factor; S - squared deviation; n_i and n_j -
- the number of observations (individuals)
- for corresponding levels.

RESULTS AND DISCUSSION

- Being a source of specific variance,
- the age of the animals and the farm have
- a significant influence on the biological
- prolificacy of Ile de France sheep raised in
- Bulgaria ($P < 0.001$). The results are shown
- in Table 1.

- Year of birth did not influence the studied
- trait. The variation coefficients were high
- as per usual, which stems from the
- character of the studied trait. Sheep of
- this breed were registered with 1 to 6

6

42.78 %,

1 | progenies. On average, the level of
- | variation was 42.78%, which was normal
- | for high fertility breeds.

1.

Table 1. Analysis of variance of the trait biological prolificacy

Sources of variance	df	F	P	CV%
Year of birth	8	1.105	n. s.	42.78
/ Age	4	9.845	***	
/ Farm	2	57.625	***	

*** – P< 0,001; ** – P< 0,01; * – P< 0,05

LS- ,
2009, 2010 (< 0.05), 2012, 2013,
2014 (< 0.05), 2015 2016 (< 0.05)
(2).
LS- -
2008 2011
(< 0.05)

Compared to their parallels,
animals born in 2009, 2010 (P<0.5),
2012, 2013, 2014 (P<0.05), 2015 and
2016 (P<0.05) were with better prolificacy
and positive LS estimations (Table 2).
Sheep born in 2008 and 2011 (P<0.05)
were characterized by the negative
deviation from the mean LS.

2. LS- (LSE)

(.)

Table 2. LS-estimates (LSE) of the effect of year of birth on biological prolificacy (lambs/ewe)

Year of birth	n	LSC	LSM ± SE
2008	4	-0.462	1.191 ± 0.303
2009	56	0.071	1.724 ± 0.093
2010	450	0.064 l	1.716 ± 0.051
2011	495	-0.009 l	1.644 ± 0.049
2012	346	0.077	1.730 ± 0.040
2013	353	0.037	1.689 ± 0.053
2014	335	0.036 m	1.690 ± 0.042
2015	206	0.053	1.706 ± 0.062
2016	168	0.133 m	1.786 ± 0.066
μ	2413		1.653 ± 0.043

μ – LS- / overall LS mean;

: A Z – P< 0.001; a k – P< 0.01; l

z – P< 0.05

Significance of differences within columns – when symbols identical: A to Z – P< 0.001; a to k – P< 0.01; l to z – P< 0.05

4 -
(1.771
) (< 0.001, < 0.01),
5-

4 year-old sheep showed the
highest fertility (1,771 lambs from sheep)
(P <0.001, P <0.01), followed by 5-year
old animals (1,760 lambs from sheep)

(1.760 < 0.05) (3).) (< 0.001, -
 (1.529 < 0.001). -
 . Dimitrov (1978) -
 - 150% (< 0.001). 6
 (< 0.001, 8 -
 < 0.01), -
 (Dimitrov, 1978). 8

(P<0.001, P <0.05) (Table 3).

The results show a high selection potential for this trait. The remaining age groups displayed negative deviations from the mean for the studied sample, with the lowest results for the first age (1,529 lambs from the sheep) (P <0.001).

This mean value is logical as a biological expression of the first lamb. Dimitrov (1978) found a well-pronounced effect of age on reproductive performance, obtaining a maximum value in the Ile de France sheep at 6 years - 150% (P<0.001). The same author stated significantly lower fertility after 8 years and at first lambing (P <0.001, P <0.01). The fertility of the breed increases and remains the same until relatively late age, which is related to the fact that the animals were not milked. This is beneficial for optimum reproductive results up to 8 years of age (Dimitrov, 1978).

3. LS- (LSE)

Table 3. LS-estimates (LSE) of the effect of the age factor on biological prolificacy (lambs/ewe)

Age	n	LSC	LSM ± SE
2 / 2 years	826	-0.124 AB	1.529 ± 0.029
3 / 3 years	605	-0.049 al	1.604 ± 0.050
4 / 4 years	443	0.118 AaC	1.771 ± 0.052
5 / 5 years	313	0.107 BI	1.760 ± 0.035
6 / 6 years	226	-0.053 C	1.600 ± 0.041
μ	2413	1.653 ± 0.043	

μ – LS- / overall LS mean;

: A Z – P< 0.001; a k – P< 0.01; l

z – P< 0.05

Significance of differences within columns – when symbols identical: A to Z – P< 0.001; a to k – P< 0.01; l to z – P< 0.05

LS-

(4).
 1 3

The obtained LS assessments for the factors “Age” and “Farm” confirmed the variance analyses in regards to the high credible influence of those two factors on fertility (Table 4).

Ewes from farm 1 and farm 3 displayed an advantage over their peers in farm 2

2 (< 0.001).
 3 1.851 .
 ,
 -
 2,
 (1.423 .) (< 0.001).

(P<0.001). With statistical results, fertility in farm 3 reached 1.851 lambs per ewe.

Farm 2 had the lowest fertility probably because the conditions of raising and feeding did not allow the breed to express its genetic potential (1.423 lambs per ewe) (P<0.001).

4. LS- (LSE)
 (.)

Table 4. LS-estimates (LSE) of the effect of the factor - farm on biological prolificacy (lambs/ewe)

/ Farm	n	LSC	LSM ± SE
1	867	0.032 AB	1.685 ± 0.024
2	1310	- 0.230 A	1.423 ± 0.022
3	236	0.198 B	1.851 ± 0.034
μ	2413	1.653 ± 0.043	

μ – LS- / overall LS mean;
 - : A Z – P< 0.001; a k – P< 0.01; I
 z – P< 0.05
 Significance of differences within columns – when symbols identical: A to Z – P< 0.001; a to k – P< 0.01; I to z – P< 0.05

1.653
 -
 Dimitrov (1978) (1.312 -
), Dimitrov t al, (1982) (1.318)
 Laleva t al., (2006) (1.306-1.372).
 Tyankov t al. (2000)
 130-140%
 ,
 180
 . Metodiev t al. (2008)
 -
 5- (1.885
 ./),
 . Metodiev t
 al., (2010)
 (1.560
),

- In our study, the main for the
 - biological prolificacy trait in Ile de France
 purebred sheep was 1.653 lambs per
 ewe. Lower values for the fertility of Ile de
 France sheep were published Dimitrov
 (1978) (1,312 lambs from sheep),
 Dimitrov et al. (1982) (1,318) and Laleva
 et al. (2006) (1,306-1,372).
 Tyankov et al. (2000) also claimed that
 the breed realized about 130-140%
 fertility, and the aim of the selection work
 followed the leading examples in the
 Bulgaria and France, where the best
 flocks reached over 180 lambs per ewe a
 year.
 Metodiev et al. (2008) established the
 highest trait values in the 5th lambing of
 ewes (1.885 lambs per ewe), which
 significantly exceeded the fertility of other
 levels in the studied flock. In another
 study of the same breed, Metodiev et al.
 (2010) shared a similar main value of the
 trait (1.560 lambs per ewe) which
 exceeded to 200% fertility when applying

200%
(< 0.05).

. Dimitrov (1978)

() 2018 .

9-10

165%,
175%.

176% - 178%,

LELEVAGE
1.550-1.783

2018

INSTITUT DE

acute feeding with roasted soy beans (P<0.05).

This experiment demonstrated the breeds' potential for production of meat when applying non-hormonal methods for increasing biological prolificacy. The reproductive characteristic of ewes includes conception rate, biological and economic prolificacy. Dimitrov (1978) suggested that characteristic should also include weight gain of lambs during the nursing stage, which is directly related to their maternal abilities.

The reproductive results were close in values to the data obtained from the 2018 report from the Breeders of the Ile-de-France Breeders Association in Bulgaria (AILFB) for the entire population raised in Bulgaria. Summarized results showed that at first insemination at 9-10 months, 150% to 165% was the realized fertility while the percentage of 1 year-old sheep increased from 165% to 175%.

The results from the three ram farms with the highest selection level were impressive. The main reproductive results were from 176% to 178 %, depending on the age of first insemination - early or standard. The small difference in fertility of the two variants proved the breeds' fast maturity and the potential for meat production.

Fertility and meat production indexes were created. Calculations of those indexes for the first selection level are forthcoming. The subsequent stage of breeding is connected to identifying the breeding values of animals. The Ile de France breed has also presented similar control data from the fertility control when bred in its home country of France. In the annual edition of INSTITUT DE LELEVAGE and the French Agricultural Academy for 2018, 1,550-1,783 lambs were reported from sheep and these are very close to our results. The study

shows that the breed has adapted successfully and, under good nutrition and cultivation conditions, can realize its full productive potential in the conditions of Bulgaria.

CONCLUSIONS

Being a source of specific variance, age of animals and farm, have highly significant effect on the biological prolificacy of Ile de France sheep raised in Bulgaria.

Year of birth does not have an effect the studied trait.

Sheep at 4 years old demonstrated highest fertility (1.771 lambs per ewe), followed by 5 year-old animals (1.760 lambs per ewe). Results show high selection potential based on this trait.

Lowest results were at first lambing (1.529 lambs per ewe).

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Improving the Composition and Quality of Rabbit Meat

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SUMMARY

The present development relates to improving the composition and quality of rabbit meat using marinade based on thyme in different concentrations - 30, 50 and 100% and marinade with spirulina in concentration - 2, 5 and 10%, which allows the obtaining of products with high antioxidant activity, which are easily treatable and have unchanged nutritional value.

Marinating rabbit meat resulted in a slight increase in moisture by 2.5% using 100% thyme and by 1% using 10% spirulina compared to the control sample, the pH did not change significantly, whereas the titratable acidity increased 2.8 times the thyme versus control and 3.1 times the spirulina versus control.

The incorporation of thyme and spirulina into the rabbit meat marinate results in a decrease in saturated fatty acids using higher concentrations of 100% thyme and 10% spirulina and improvement of the fatty acid composition with respect to monounsaturated fatty acids in thyme - 32.30 g/100g fat and 39.63 g/100g fat in

2, 5 10%,
- 30, 50 100%
100% 2,5 % 1% 10%
3,1
- 100%
10%
- 32,30

g/100g - 39,03
 g/100g , -
 28,37 26,34 g/100g , .

spirulina as well as polyunsaturated fatty acids and 28.37 and 26.34 g/100g fat respectively.

Key words: rabbit meat, thyme, spirulina, fatty acids

INTRODUCTION

In recent years there has been an increase in consumer demand for healthier food products, based on this the meat industry, has been devoted to developing new strategies to optimize the meat and meat product's nutrition to improve its image (Toldra and Reig, 2011). Rabbit meat is low in fat and superior to all other types of meat with protein content (on average 22%) and their ratio (complete/incomplete).

The rabbit meat protein content is 90% and the beef, for example, only 64%. Rabbit meat also contains at least cholesterol compared to other animal feeds (except milk).

Therefore, it is recommended as a diet for people, suffering from high blood pressure, liver disease, atherosclerosis, gastritis, and other diseases of the cardiovascular and digestive system.

According to the content of vitamins and minerals, the rabbit overtakes all other types of meat. It is rich in vitamin C, vitamins from group B, niacin, minerals - phosphorus, iron, cobalt, manganese.

Rabbit meat contains a small amount of sodium, has low calorie content and is therefore very appropriate for diets. Continuous or frequent consumption of meat dishes from a rabbit helps to normalize the metabolism of proteins and fats in the body.

Lipid oxidation in meat is a process that has a significant impact on the quality, acceptability and shelf life of meat products. The final products of this

(Toldrá and Reig, 2011).

(22%)
 (/)
 90%,
 64%.

().

(Gray et al., 1996).

(Kanner, 2007; Peiretti and Meineri, 2011).

(Mayne, 2003).

(Laguerre et al., 2007; Muselík et al., 2007).

- process lead to discoloration, unnatural smell, taste and texture of meat and meat products, as well as loss of nutritional value (Gray et al., 1996).
-
- In addition to worsening of food quality, lipid oxidation generates cytotoxic and genotoxic compounds which are harmful to human health (Kanner, 2007; Peiretti and Meineri, 2011).
-
- It is believed that this oxidative stress leads to the development of many chronic and oncological diseases, cardiovascular diseases, as well as to the intensification of the general processes of aging in the body (Mayne, 2003). In order to control lipid oxidation in meat and meat products, the use of antioxidants is the most effective and convenient method (Laguerre et al., 2007, Muselík et al., 2007). To obtain a positive result, it is necessary to find a suitable concentration in which an antioxidant is most effective for a particular substrate.
-
- The main disadvantages of such foods, containing synthetic antibacterial and antioxidant stabilizers, are partial loss of acceptable color, structure, smell, taste and nutritional qualities. In addition, the cumulative effects of added substances, as well as the interaction between different food additives and chemicals compound taken on another occasion, have a negative impact influence on the healthy nutrition and lifestyle.
-
- For these reasons, in the recent years, there has been an increasing demand for high-quality food products that have been obtained through sparing technological processes that retain the natural qualities of products, making them healthier (less salt, sugar, fat, calories and synthetic stabilizers) and at the same time safer.
-
- Preferences of consumers for natural foods, direct the scientific research

Montet, 1998). (Collignan and

(*Arthrospira platensis*)

12

(Peiretti and Meineri, 2011),
(*Thymus serpyllum*)

(Sikorski and Kolodziejska, 1986; Schutte, 2008).

50 100%

2, 5 10%,

1:15
24 h.

30%, 50% 100%

2%, 5% 10%

250 g,
: () -
;

- into the possibilities of using a natural
- antioxidants. It has been found that
- rosemary, green tea, ginger, majoran and
- thyme show a strong inhibitory effect on
- the lipid oxidation of meat products
- (Collignan and Montet, 1998).

- The possibilities for the incorporation of
- biologically active substances from plant
- propagation into the food technology as
- antioxidant stabilizers, especially in the
- preparation of raw meat products, have
- not been fully investigated.

Spirulina (*Arthrospira platensis*) is confirmed as a rich source of vitamin B12 and is an effective natural supplement in the production of foods enriched with this vital element, which is successfully applied to the meat (Peiretti and Meineri, 2011), while the thyme (*Thymus serpyllum*) improves the oxidation stability of raw and lyophilized meat (Sikorski and Kolodziejska, 1986; Schutte, 2008).

The purpose of this study is related to improving the composition and quality of rabbit meat using marinade based on thyme in different concentrations - 30, 50 and 100% and marinade with spirulina in concentration - 2, 5 and 10%, which allows the obtaining of products with high antioxidant activity, which are easily treatable and have unchanged nutritional value.

MATERIAL AND METHODS

- An aqueous thyme extract was prepared in a proportion of the hot water diluted 1:15 and the resulting solution was maintained for 24 hours. Marinating solutions were prepared from the base solution at 30%, 50% and 100% thyme. In parallel, marinade was prepared from 2%, 5% and 10% aqueous spirulina.

- Pieces of raw rabbit meat with weight 250 g were prepared in advance in seven groups: control (C) - raw rabbit meat untreated; raw rabbit meat treated with

(1);
50%

(3);
2 %

(4);
5%

(6).

48 h.

-
-
Thermocontrol Sartorius,
,
,
NaCl
%.

Bligh and Dyer
(1959),
1:2.
(FAME)

Shimadzu-2010 (Kyoto,
Japan).
CP7420 (100m x 0,25mm
i.d., 0,2µm film, Varian Inc., Palo Alto,
CA),
-
make-up
.

(Peiretti and Meineri,
2011; Sikorski and Kolodziejska, 1986;

30% thyme solution (T1); raw rabbit meat treated with 50% thyme solution (T2); raw rabbit meat treated with 100% thyme solution (T3); raw rabbit meat treated with 2% solution of spirulina (S4); raw rabbit meat treated with 5% solution of spirulina (S5); raw rabbit meat treated with 10% solution of spirulina (S6). Marinating rabbit meat was carried out for 48 hours.

- The following physicochemical parameters of rabbit meat - active acidity with pH-meter, total solids with Thermocontrol Sartorius, titratable acidity expressed as acid number and determination of salt titrimetric expressed as NaCl % were investigated.

The extraction of the total lipids was performed by the method of Bligh and Dyer (1959) by chloroform and methanol in ratio of 1:2. The methyl esters of the fatty acids were analyzed using gas chromatograph Shimadzu-2010 (Kyoto, Japan). The analysis was carried out on a capillary column CP7420 (100 m x 0.25 mm i.d., 0.2 m, Varian Inc., Palo Alto, CA), with carrier gas - hydrogen and make-up gas - nitrogen. It is programmed furnace regime of five steps.

RESULTS AND DISCUSSION

- In recent years, there has been an increasing demand for high-quality food products obtained through sparing technological processes that retain the natural qualities of the products to make them healthier (less salt, sugar, fat, calories and synthetic stabilizers) and at the same time safer. Consumer's preferences for natural foods direct research into the use of natural antioxidants.

It has been found that a number of herbs and spices show a strong inhibitory effect on the lipid oxidation of meat products (Peiretti and Meineri, 2011; Sikorski and

Schutte, 2008).

(*Arthrospira platensis*)
 (100% solution) - 28,35%
 (10% solution) - 27,27%
 25,76
 1).

Kolodziejska, 1986; Schutte, 2008). For this reason, it is important to investigate the effect of natural antioxidant stabilizers on improving the quality of meat products and assessing the marinade effect with the spirulina (*Thymus serpyllum*) and thyme (*Arthrospira platensis*) food additive. The total solids in the analyzed meats varied as follows - 28.35% in the control and decreased in the process of marinating with thyme (100% solution) to 25.76 and less with the use of spirulina (10% solution) - 27.27% (Table 1).

1.

Table 1. Indications of rabbit meat

Parameters	TS, %	pH	Titrateable acidity, ()	NaCl % Salt- NaCl %
Rabbit meat	28,35	5,98	1,35	0,0877
Rabbit meat with 100% thyme solution	25,76	5,96	3,81	0,095
Rabbit meat 10% spirulina solution	27,27	5,78	4,19	0,0877

100% 2,5 % 1% 10%
 2,8
 3,1
 (0,087-0,095 % 100g)
 2).

Marinating rabbit meat leads to a slight increase in moisture by 2.5% using 100% thyme and 1% at 10% spirulina compared to the control sample, the pH did not change significantly while the titrateable acidity increased 2.8 times in the thyme versus by the control and 3.1 times for spirulina versus by the control.

The salt content data are in the standard values (0.087-0.095% in 100g product) for all tested variants

Studies have been conducted on the fatty acid composition of the seven groups of meat to detect lipid changes as a result of treatment with different concentrations of natural antioxidants (Table 2).

2.

Table 2. Fatty acid composition of rabbit meat

Group FA	Control		1 T1		2 T2		3 T3		4 S4		5 S5		6 S6	
	X	SD	X	SD	X	SD	X	SD	X	SD	X	SD	X	SD
SFA	47,37	9,12	50,70	1,13	43,16	1,22	34,48	1,57	50,43	1,31	41,63	1,50	31,35	1,95
MUFA	25,78	2,82	25,41	0,57	36,22	3,20	32,30	0,78	26,26	0,29	33,13	2,31	39,03	3,80
PUFA	19,43	0,85	19,17	0,43	19,45	1,97	28,37	0,68	22,65	0,63	17,61	3,91	26,34	1,64
C-18:1TFA	2,10	2,39	3,17	0,07	1,40	0,05	5,18	0,15	1,06	0,45	4,35	0,30	9,05	0,22
n-3	0,94	0,04	2,66	0,06	2,58	0,77	1,31	0,03	4,12	0,43	4,09	1,95	3,28	0,20
n-6	19,86	0,87	16,64	0,37	16,84	1,20	27,06	0,65	18,53	0,44	13,84	1,95	26,20	1,23
n-6/ n-3	21,13	0,00	6,26	0,00	6,77	1,56	20,58	0,00	4,50	0,44	3,69	0,87	8,02	0,79
C-18:1 CFA	6,29	0,61	11,18	0,25	22,05	0,62	14,77	0,35	18,97	0,89	15,27	1,07	14,36	1,61
BFA	5,48	0,10	3,25	0,07	1,41	0,04	4,82	0,12	0,67	0,39	7,75	0,54	3,52	0,22

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SFA

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These recommendations for healthy nutrition give priority to reducing the consumption of saturated fatty acids (SFA) in order to prevention and protection of cardiovascular diseases.

- On the first time, significant data show that the health effects of reducing SFAs vary depending on the replacement nutrient.

- Based on the best evidence from human studies, replacing SFA with PUFA (eg vegetables, oils) reduces the risk of coronary heart disease, while replacing SFA with carbohydrates has no health benefits (Gray et al., 1996).

- Saturated fatty acids (SFA) in the analyses meats were the highest in variant 1 with thyme and variant 4 with spirulina (Table 2). Decreasing the concentration of SFA in the analyzed samples was attained to the highest degree in S6 with spirulina - 31.35 g/100 g fat, compared to the control of rabbit meat - 47.37 g/100 g fat.

- Monounsaturated fatty acids (MUFA) are almost the same concentration in the control, T1 and S4, where the concentration of food supplements is the

6,5 13,3%,
 6, MUFA
 (PUFA) - 19,43 g/100g
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 4/1.
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 6

lowest. In the other variants, an increase in MUFA as a result of meat treatment from 6.5 to 13.3% was found, with T2 and S6 being highest for MUFA, which is due to the higher content of cis-isomers in the first treated meat group and the trans-isomers in the second treated meat group.

The results for polyunsaturated fatty acids are similar (PUFA) - control - 19.43 g/100g fat and the highest value for T3 and S6, due to the increase in omega-3 and omega-6 fatty acids compared to the control sample.

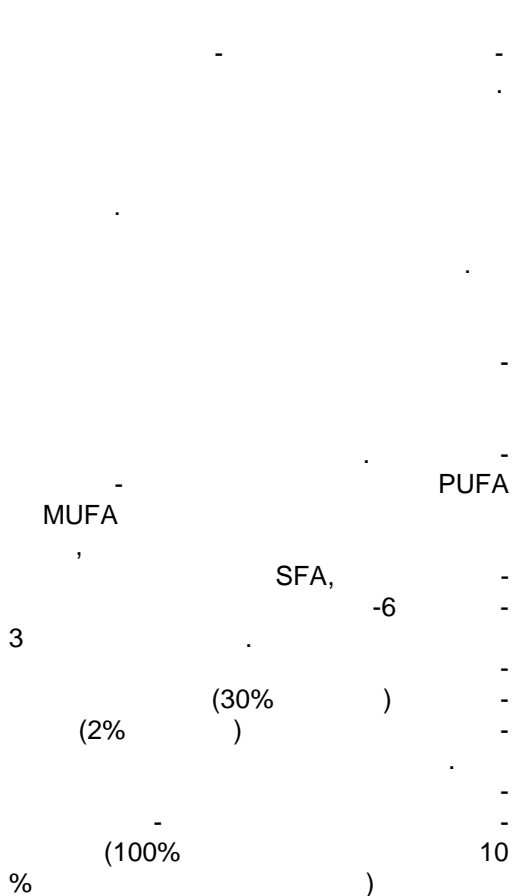
Thyme treatment leads to a decrease in the branched fatty acid content relative to the control, indicating suppression of the microbiological processes, while 5% spirulina treatment is observed to increase.

In the history of human nutrition, the intake of omega fatty acids is important to have a low ratio of omega-6 and omega-3 fatty acids ranging from one to five when compared to existing diets where its value reaches 20 and more units, which is the basis of many diseases.

Healthy nutrition is characterized by a ratio of omega-6/omega-3 fatty acids in the range from 1/1 to 4/1.

The results obtained in the treated meats with thyme and spirulina show unambiguously that their application improves the balance of this ratio from 21.13/1 in the control to a ratio 3.69 ÷ 8.02 in five of the other 6 variants.

The established changes in fatty acid concentration during the individual stages of the work could be related to the ongoing hydrolysis and lipolysis, although to a low degree. As a result, conditions are created for the formation of primary



and by-products at a later stage of lipid oxidation. No loss of essential fatty acids and nutritional value is observed in the processing of rabbit meat. Treatment of this type of meat does not cause the formation of free radicals dangerous to human health.

CONCLUSIONS

The use of thyme and spirulina as a food additive for rabbit meat leads to an improvement in the fatty acid profile. They are established higher concentrations of PUFA and MUFA than the control group were detected at the expense of a decrease in SFA concentration as well as a lower ratio of omega-6 and omega-3 fatty acids.

According to the results obtained the use of low levels of thyme (30% solution) and spirulina (2% solution) did not significantly change the fatty acid composition. For this reason, we recommend using the higher concentration levels (100% thymine solution and 10% spirulina solution) of these dietary supplements.

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Beekeeping Marketing in the Circular Economy of the Region of Strandzha

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SUMMARY

- The purpose of the study is to determine the place and the role of marketing in the circular economy of
- beekeeping from the Strandzha region. In accordance with this purpose, the tasks include: 1. Forestry in the Strandzha region as a basis for establishing unique bee products; 2. Marketing and design of the bee products from the Strandzha region; 3. Local and online markets, short supply chains for bee products and apitourism. Marketing has a key role in the circular economy of beekeeping from the Strandzha region because it defines the bee products that are produced in the unique forestry of Strandzha, their design and production, and the markets for which they will achieve competitiveness. It can develop the potential of bee products from the Strandzha region, and significantly increase their sales. The relationship between the forestry in the Strandzha region, that includes both natural and human factors, and the unique characteristics of the bee products

produced there, allows beekeepers from Strandzha to establish a protected designation of origin (PDO) "Strandzhanski manov med" (Strandzha Honeydew), as well as to apply for other geographical indications. Branding using geographical indications and domain name increases the competitiveness of beekeeping farms from the Strandzha region and allows realization at local and online markets, formation of short supply chains, rural and apitourism. The domain name and the online markets are important for the digitalization and the development of the beekeeping of Strandzha Region because they represent it at global, national and regional level.

Key words: forestry, marketing, local and online markets, short supply chains, api-tourism.

INTRODUCTION

The concept of circular economy complements and enriches the traditional economy, which is characterized by a linear process aimed at high productivity and low production costs, relying on the abundance of raw materials at a relatively low price. In December 2015, the European Commission published an Action Plan for the Enforcement of a Circular Economy as a Policy for Sustainable Development. This plan aims to stimulate Europe's transition to a circular economy, which in turn will enhance its global competitiveness, will stimulate the sustainable economic growth, will create new jobs and preserve the flora and fauna of the environment for the future generations. The transition will be supported financially through European structural and investment funds.

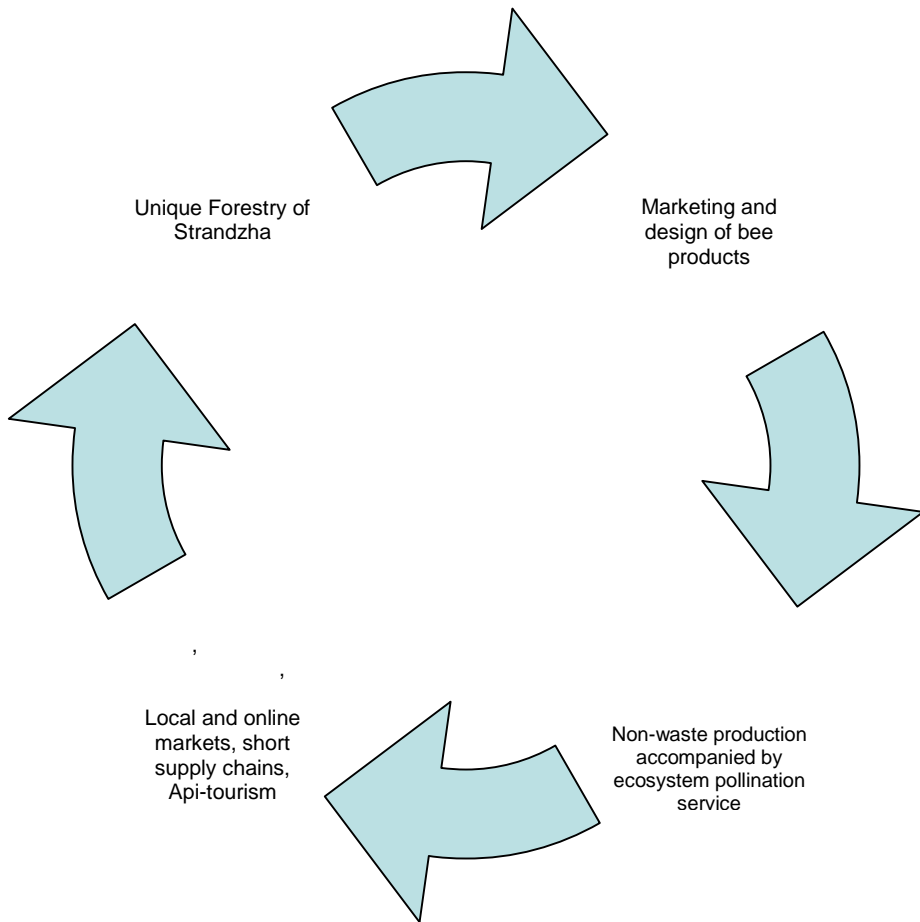
The circular economy is based on renewable energy and low environmental impact by limiting the amount of waste and the excessive use of resources by

, turning used products into resources for
- other products through re-use, secondary
- production, recycling, waste reduction and
- other practices.

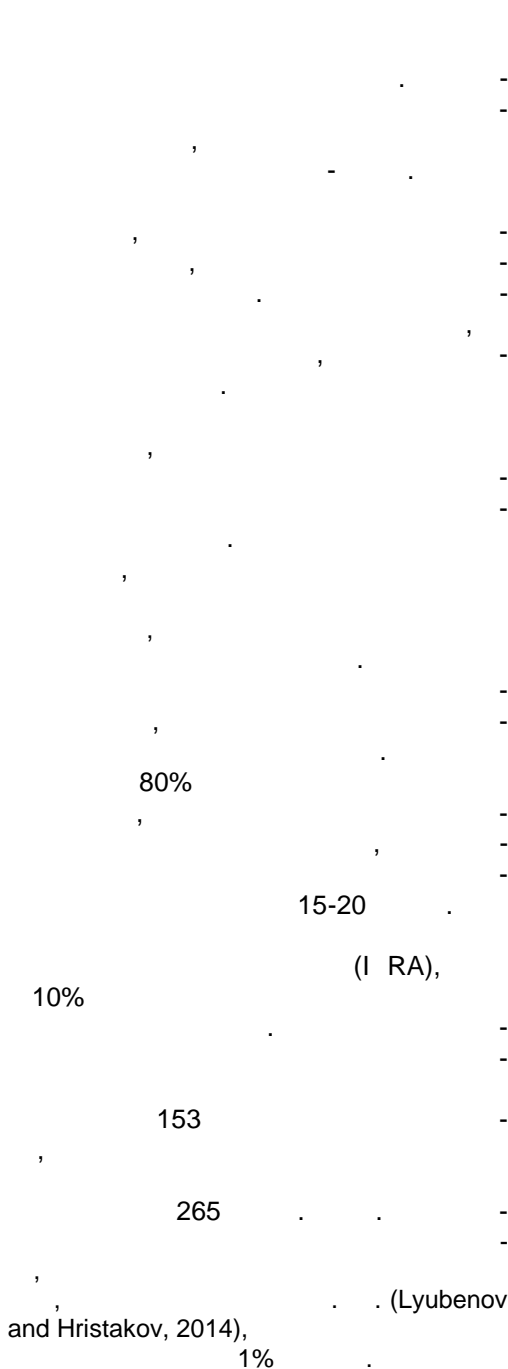
. This requires business partnerships to
- create and develop technologies that
- have beneficial effect on the environment,
- the biodiversity and the economy, such as
- the pollination by bees.

- The Circular Economy requires a multi-
- stakeholder approach to "close the circle"
- within the life cycle of bee products with a
- non-waste production cycle (Figure 1).

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Fig. 1. Circular economy of beekeeping in Strandzha



The Strandzha forest massifs provide conditions for the production of unique bee products. Marketing must be done before production, in order to avoid conflicts between production and the market. Marketing is important for the development of beekeeping in Strandzha, because without markets for its products, it cannot develop and prosper.

Once marketing defines the bee products, they also will need design in order to be competitive. The production of bee products is accompanied by pollination, which is fundamental and important for preserving global biodiversity and ecological equilibrium. Local and online markets, short supply chains and tourism reduce the costs for realization, preserve the environment and provide jobs.

The role and the importance of honey bees for pollination of agricultural crops is enormous. Bees pollinate 80% of the flowering plants, and they make it possible to produce one-third of the food, whose value is 15-20 times greater than the price of all bee products.

According to the International Bee Research Association, this is 10% of the value of the production of the agricultural sector. The global contribution of bees to the agricultural production over the past decade is estimated at 153 billion US Dollars, and the current positive effects of pollination globally are estimated at 265 billion Euro.

In Bulgaria, the economic effect of pollination, based on the bee honey market, exceeds 1 billion Bulgarian Leva (Lyubenov and Hristakov, 2014), which currently exceeds 1% of GDP.

The facts demonstrate that the market for pollination has great prospects and potential for development, but nowadays its actual condition in Bulgaria is negligible due to the lack of all-round

- developed plant breeding, low assessment of the general public and professionals, inadequate legislative base, etc., thus it is still in the early stages of its development. There is a significant disparity between the rapid development of global organic markets and the agribusiness in Bulgaria over the last decade, and also there is a lack of a developed domestic market for pollination. Globally, there is a significant decrease in honeybee population, which threatens biodiversity and the ecological equilibrium. It is necessary to provide subsidies for the ecosystem pollination service to all beekeepers in the EU.

The lowest export of Bulgaria from 2012 to 2016 is in the last year (Table 1). Regardless of this fact, Bulgaria still occupies the 8th place in the EU and 13th in the world when it comes to the export of nectar honey – 32 million US Dollars (Directorate “Market Measures and Producer Organizations”, 2018). For the first three years of this period, the exports exceed the domestic production, and for the past two years they account for more than 87%, which shows a steady increase in imports, with about 50% are imports from the Ukraine. Bee honey ranks 12th among the most exported Bulgarian agricultural products, and no other Bulgarian agricultural product is exported so much to international markets. Bulgaria has a significant production and export potential not only for honey, but even more so for other bee products (Lyubenov, 2017).

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Table 1. Domestic production, export and import of bee honey

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Honey, thousand tons	6,14	11,4	9,53	10,6	9,6	9,2	10,1	9,3	11,4	10,2
Export, thousand tons	3,81	3,36	6,12	8,54	6,85	10	13,4	10,9	10,4	8,9
Import, thousand tons	0,24	0,85	0,2	0,23	0,29	0,7	1,9	1,2	1,5	2,2

“ / Directorate “Market Measures and Producer Organizations”, 2018, Lyubenov L., 2018b

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(Lyubenov, 2017).

(Lyubenov,

- Considering the high requirements and competition on the international markets, the quality and marketing of its products are limiting factors for the development of the export potential of Bulgarian beekeeping. Although 33% of the domestic production of nectar honey is organic (Agrarian Report, 2018), it is mainly used as a raw material, and this high-quality product remains unrecognizable on global markets due to poor marketing.

- Honeydew from Strandzha can also be qualified as a unique organic product because of the pristine natural conditions in the oak forests of Strandzha where most of it is produced – about 50 to 100 tons per year (<https://www.monitor.bg>, 9 October 2017), which represents about 0,5-1% of the total honey production in Bulgaria.

- Measured in actual amounts, bee honey accounts for more than 90% of the structure of Bulgarian bee products (Table 1). Considering the market and the production potential of other bee products can reduce its share to about 20% in value without considering the potential of the ecological pollination service.

- Under identical conditions, bee pollen can take about 20%, bee jelly about 25%, and bee venom about 35%, but only when marketing is used to realize their full potential. It should also be considered that, in perspective, the pollination market has the potential to go beyond the domestic organizational markets for bee honey and bee pollen, respectively their relative shares in the product structure of Bulgarian beekeeping (Lyubenov, 2017).

- Today, Bulgarian beekeeping uses only a small part of its potential, mainly due to the lack of good marketing, and Bulgarian nectar honey realizes only about half of its potential (Lyubenov, 2017). Marketing is the main driving force

2017).

- for developing the potential of Bulgarian
- bee products, and respectively those from
- Strandzha.

- It can significantly increase the sales of
- unique bee products from Strandzha –
- bee honey and bee pollen, and in
- perspective- of bee jelly, bee venom, etc.
- This will allow to diversify and realize
- higher incomes from beekeeping in
- Strandzha, which will contribute to the
- social and economic development of the
- region and its forestry, while preserving
- the ecosystems by pollination.

- The increasing competition on
- global, European and regional markets for
- bee products lowers their prices.

- This negative decline of prices is
- highlighted by stressing on the quantity of
- the bee products being made and on the
- absorption of the subsidies. Marketing is
- needed to create desirable and unique
- high value-added bee products in order to
- achieve non-price competitiveness.

- Marketing has a key role in the circular
- economy of beekeeping in Strandzha,
- because it defines the bee products, their
- design and production, and the markets
- on which they will achieve
- competitiveness due to providing
- ecosystem pollination service and
- enrichment of local flora and fauna.

- The purpose of the study is to
- determine the place and role of marketing
- in the circular economy of beekeeping
- from Strandzha. In accordance with the
: 1. established purpose, the tasks are as
follows: 1. Forestry of Strandzha as a
basis for establishing unique bee
products; 2. Marketing and design of bee
; 2. products from Strandzha; 3. Local and
; 3. online markets, short supply chains for
- bee products and api-tourism.

MATERIAL AND METHODS

- The Bulgarian studies on marketing and circular economy of bee products are only a few. This is why the practical experience, the theoretical experience and individual long-term observations and studies done by the author for the marketing of bee products are used. The research methods include the complex combination of induction, deduction, grouping, comparison, analysis, synthesis, abstraction, concretization, analogy, modelling, formalization, observation, experimental, mathematical, graphic.

RESULTS AND DISCUSSION

- According to the aim of the study, it is focused on the analysis of the tasks through which it will be accomplished. It has been created a well-built and logical three-part structure, showing the place of marketing in the circular economy based on a specific example - the beekeeping of the region of Strandzha. Marketing covers the largest number of business processes and determines competitive products, and therefore it is a starting point for developing a marketing strategy - including of the beekeeping in the region of Strandzha. There is relatively little research and specialized literature which has been dedicated on the analysed problem.

The forestry of Strandzha as a basis for establishing unique bee products

- The territory of Strandzha covers many protected areas and natural habitats, thus making it a favourable

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environment for honey bees and for the development of beekeeping. Strandzha is recognized as one of the five priority conservation areas in the EU, which is included in the pan-European ecological network "Natura 2000".

The oak and beech are the predominant forests in Strandzha, with the highest share of oak forests being *Quercus petraea* with 47,8%, followed by 41,8% of *Quercus frainetto*, which provides living for the producers of the so-called "Honeydew" (manna) – aphids, acorns and oak seed eater. The lack of industry and infertile cinnamon-coloured forest soils and yellow-ground subsoil soils limit the cultivation of crops that, when flowering, can affect the quality of bee products.

In the Strandzha region, honey bees produce honeydew from the secretions of living parts of plants and excreta of sucking insects. The generation of so called "honey dew" by the abovementioned insects and plants, including the sweet liquid of the oak acorns, are the raw materials from which the honey bees produce honeydew. The unique plants, insects and climate on the territory of Strandzha produce unique honeydew. It differs from nectar honey mainly because it has high electrical conductivity due to the high content of trace elements – potassium, magnesium, lithium, manganese and antioxidants. It is characterized by the high content of melezitose and erlozis, as well as the presence of quercetin and kestosis.

The forest vegetation of Strandzha is characterized by the presence of large oak massifs (more than 70% of the territory) and beech, and the typical mild

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³ These are markets within a radius of 75 km from the farm of origin of the product; in this radius the product must be both processed and sold to the end user. The EU's Common Agricultural Policy (CAP) for the period 2014-2020 supports their formation, including through funding.

⁴ A supply chain involving a limited number of economic operators committed to cooperating and dedicated to local economic development and close territorial and social relations between producers, processors and consumers. The EU CAP for the period 2014-2020 supports their formation.

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- climate (with sufficient air humidity, moderate temperatures, spring and summer mists), which favours the generation of the honeydew and its collection by the bees. It is typical for Strandzha that the main grazing of bees during the months of June, July and August is the oak honeydew. During the collection of the honeydew in Strandzha there are no other species that generate honeydew in such abundance, such as massifs of acacia, linden, etc., which blossom and consequently may mix honeydew with nectar. The content of the honeydew which bees feed on is the cause of the higher content of trace elements and antioxidants in this type of honey compared to the nectar. The colour saturation, the slightly acidic and bitter taste are the result of the microflora in the honeydew and the period for collecting it.

The Strandzha forest massifs provide conditions for the production of unique bee products. This allows the Strandzha beekeeping farms to register a legally protected intellectual product such as GI (Marks and Geographical Indications Act, 2018) or to register as its users because the unique qualities of their bee products are mainly due to the specific natural factors of this geographical area.

Since there is no GI for a bee product from Strandzha, they must first establish it and they can choose between an appellation of origin and a geographical indication (GI). The registration of GI has no time restriction and can be protected in national, European and international registers, once it is well-known for its qualities on the market.

The relationship between the forestry in Strandzha, which includes both natural and human factors, and the unique characteristics of the honey produced in it, allow Strandzha beekeeping farms to apply for a "Strandzha honeydew" protected

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designation of origin (PDO). The area of production of this honey is defined on an administrative basis according to the specific natural and climatic conditions, and includes the municipalities of Sozopol, Primorsko, Tsarevo, Malko Tarnovo and Sredets. The unique flora and fauna of the geographical area influences the organoleptic characteristics of the honey and its aroma. That is why "Strandzhanski manov med" (Strandzha honeydew) differs significantly from the bee honey produced elsewhere because of the relationship between it and the forestry of Strandzha.

" The PDO "Strandzhanski manov med" (Strandzha honeydew) will be harvested in apiaries (mostly stationary ones) located in the oak forests of Strandzha and as a rule – within the outlined geographical area. Throughout the whole year, the bee families will be located only in the defined geographical area. The bees will not be permitted to graze during the harvesting period – the months of June, July and August. The bees can be fed in the spring and after the honey is removed before the winter in quantities necessary for the survival of the bee family. It is permissible for bee families to be fed with sugar, sugar dough, sugar syrups and honey of own production. Winter stocks should not fall under the Strandzha honeydew PDO which is intended for the market.

The Strandzha honeydew will be harvested only in apiaries which have a registration number, hold a certificate for a farm entity, and maintain a veterinary and medical journal. The extracted "Strandzhanski manov med" (Strandzha honeydew) will be divided into lots with clear marking and labelling to ensure traceability. Each storage container will clearly indicate the batch number, and the date and place of production. Honey will be stored in food containers. The dosing, packaging and labelling will be done in clean and suitable premises. The

42 °C,

crystallized honey will be liquefied by heating at a temperature of no more than 42°C, which is reached in the beehive during the collecting of honey. In compliance with the legislation for PDO products there will be an independent controlling person who will perform quality control.

Evidence of the uniqueness of "Strandzha manna honey" PDO will be the pollen content of Strandzha plants, the presence of quercetol, kestosis, higher levels of melicitosis and high phenol content, higher levels of potassium, magnesium, lithium, manganese and minerals in comparison to nectar honey. The composition of the mana used to feed the bees is the cause of the higher content of trace elements and antioxidants in this type of honey against the nectar honey. "Strandzhanski manov med" has a noticeably darker colour, a specific aroma and a slightly acidic and bitter taste compared to nectar honey. The content of trace elements and salts is 10 to 30 times greater. A specific feature of Strandzha honeydew is its particularly high electrical conductivity compared to other types of honeydew – necessarily more than 0.95 mS/cm.

10 30

0,95 mS/ m.

The pollen characterization of honeydew from Strandzha is influenced by specific plants, which are unique in Bulgaria.

Another unique bee product, which is produced in the forestry of Strandzha, is bee pollen. That is why the beekeepers from Strandzha intent, upon receiving the Strandzha honeydew PDO, to apply for the Strandzha flower bee pollen PDO, which has tertiary relicts and endemites, which are plants and bushes that grow only in Strandzha.

The presence of these pollens are clear and reliable markers for a clearly proven origin. The Strandzha flower bee pollen contains significant amounts of the

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pamukliyka (Cistus incanus), which contains the biggest number of polyphenols in Europe. Every year, the beekeepers from Strandzha can produce 2 to 3 kg of bee pollen excluding the pollen from technical crops.

Marketing and design of the bee products from Strandzha

Bulgaria is one of the world's largest producers of honeydew, and the main yield comes from Strandzha, where one of the highest quality types of honey in Europe and in the world is produced. Since 2004, every year in the town of Tsarevo is held a festival of "Strandzhanski manov med" and "Strandzha flower pollen". "Strandzhanski manov med" is offered at various domestic festivals – in Sofia, Varna, Nessebar, Stara Zagora, Plovdiv, Pleven and others, as well as at a number of international exhibitions – Turkey, Serbia, Romania, Biophach – Germany; congresses – in Slovenia, the Ukraine; symposia and conferences – in the Kingdom of Norway, Hungary and others. (www.mzh.government.bg, March 2019). The traditions in producing Strandzha honeydew, its specific characteristics and its distinctive qualities are highly appreciated by consumers.

Research of a team of scientists from the Bulgarian Academy of Sciences about producers of the oak honeydew in Strandzha (2003-2007) undoubtedly demonstrates the mechanism for the production of "Strandzhanski manov med" through the aphids and the proboscises. The unique character of "Strandzhanski manov med" is confirmed by the analyses and researches carried out by the Joint Genome Centre at the University of Sofia "St. Kliment Ohridski" in 2014. "Strandzhanski manov med" is presented at the "Bee Village" in Brussels (2013, 2015), where it is highly appreciated by the citizens and guests of Brussels. During the European Bee and Pollination Week in 2016 in Brussels, the Strandzha

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„ („Strandzhanski manov med“) / „ („Manov med ot Strandzha“).

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honeydew attracted a lot of interest. For the presentation of the unique qualities of "Strandzhanski manov med" there are many publications in the periodical press and in the media.

In 2008, the "First World Symposium on Honeydew" was organized, and in 2018 "World Honeydew Symposium – 10 Years Later" which focused on a very topical issue concerning the losses of bee colonies worldwide – pollination, pollinators and ecosystem services. The symposia are held in the town of Tsarevo with the participation of beekeepers, specialists and scientists from Europe, Africa, Asia and the USA during the Festival of Strandzha honeydew, and the 15th festival took place in 2018. The latest Symposium informs the interested institutions in the EU about the need to aid and pay beekeepers for the ecosystem services they provide as they benefit everyone and concern the preservation of biodiversity and the environment, thus playing an important role in the circular economy.

The "Strandzha manna honey" association, registered in the town of Tsarevo, has started the procedure for registering a product with a protected designation of origin (PDO) by applying to the European Register of Protected Designations of Origin and Protected Geographical Indications. The association indicates the name of the product "Strandzhanski manov med" / PDO "Manov med ot Strandzha" (Honeydew from Strandzha). The application is published on the website of the Ministry of Agriculture, Food and Forestry for justified objections till the end of October 2017.

The application for the product has received the approval of the European Commission's Directorate-General for Agriculture and Rural Development, and in the autumn of 2018 (Official Journal of

<p>(, 13.12.2018 .),</p> <p>6 2019 .</p> <p>“</p> <p>(,)</p> <p>“</p> <p>”</p> <p>”</p> <p>“</p> <p>1500 g,</p> <p>“</p>	<ul style="list-style-type: none"> - the European Union, 13.12.2018) with a deadline for objections which expired on 6 March 2019, is published in the Official Journal of the European Union. <p>Beekeepers who wish to register as users of PDO “Strandzhanski manov med“ must meet the criteria set out in its specification. They must be in the defined region of Strandzha (the municipalities of Sredets, Sozopol, Malko Tarnovo, Primorsko and Tsarevo) and must have certain technical equipment, facilities and inventory.</p> <ul style="list-style-type: none"> - It is also necessary to have rooms for using centrifuges, for raw materials, as well as warehouses for finished products. - The construction of suitable premises as well as the equipment with equipment to fulfil the set criteria require investments of several tens of thousands of Bulgarian levs. Only bee farms that meet these requirements will be able to sell the honey produced under the PDO “Strandzhanski manov med”. <p>It is imperative that all stages of production of the PDO “Strandzhanski manov med” are carried out in the defined geographical area in order to ensure the high quality of the product and its complete traceability. In order to ensure the quality and preservation of the organoleptic and physical and chemical characteristics of the PDO “Strandzhanski manov med”, packaging and labelling will be done only in the defined geographical area. Thee individual packages should not exceed 1500 g and the bulk sale of "Strandzhanski manov med" is forbidden.</p> <ul style="list-style-type: none"> - The control of the abovementioned PDO will be carried out both by the Regional Food Safety Directorate and by an independent certification body that has a contract with the beekeepers for inspection and control.
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This will be the first product in

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Bulgaria with a protected designation of origin since there are only two other Bulgarian products with protected geographical indications – PGI “Gornooryahovski Sudzhuk”, “Bulgarsko rozovo maslo”. The difference is that for the PDO „Strandzhanski manov med“ all stages of production will be carried out in the outlined geographical area, which covers the territory of the entire Strandzha region – the municipalities of Sredets, Sozopol, Primorsko, Tsarevo and Malko Tarnovo. PDO "Strandzhanski manov med" allows differentiation and a better price for registered producers. It also provides the opportunity to strengthen the development of local honey production, tourism, crafts, etc., which will protect the local economy from depopulation – the density of the population in the Strandzha region is 5-6 people per square kilometre, while for Bulgaria it is 75.

The production of honeydew is traditional for the population of Strandzha, which has about 500 beekeepers. They are potential users of the “Strandzha manov med” PDO if they meet the criteria laid down in its specification. With the registration of Strandzha flower bee pollen as a PDO, the Strandzha forestry will become the leader in the EU, considering that only five European countries have registered PDOs (<http://fermera.bg>, 03 August 2018).

This will improve the image of the region, will diversify, increase and stabilize the incomes of the local population. Pollination, maintenance of ecosystems, ecological and biodiversity of Strandzha forestry will be improved, all of them very important for the circular economy and the accelerated economic development.

The "Strandzhanski manov med" Association is the initiator to register one of the legally protected forms of GI in the European Union – PDO "Strandzhanski manov med", for which all processes of production, processing and packaging are

carried out in one region – Strandzha. For the other form of GI in the European Union – the Protected Geographical Indication (PGI), one of the processes is carried out in the specified region. Intellectual Property Law (PDO and PGI) is collective and cannot be monopolized by one owner. No license may be given, nor the right of use can be transferred.

The PDO "Strandzhanski manov med" helps preserve natural resources, local traditions and cultural heritage. It provides opportunities for participating in EU funded promotional programmes and instills loyalty in users through its authenticity and quality.

The EU has established symbols (logos) that are obligatory for the Member States and are used to designate the legally protected intellectual products – PDO, PGI, etc., which combine in themselves collective and certification marks. Therefore, the PDO "Strandzhanski manov med" provides support above national level can benefit all beekeeping farms in Strandzha. The Farming Association "Strandzha honeydew" is a leading integrator for creating a legally protected intellectual product under the same name, although non-agricultural enterprises and associations are traditionally more active in this domain (Lyubenov, 2015). If the integrator was non-agrarian the beekeeping farms in Strandzha would have become mainly its suppliers of honeydew as a raw material.

The "Strandzhanski manov med" (Strandzha honeydew) Association is the main initiator and organizer of a number of events together with state and municipal institutions, non-governmental organizations and others. It is a generator of horizontal integration processes between beekeeping farms in Strandzha. The Association conducts a common product, innovation, communication and

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other marketing policies which in fact is joint marketing. The latter is the most complex form of marketing that allows the implementation of the complete marketing toolbox by the beekeepers in Strandzha to create products with high added value.

Through it, beekeeping farms have better opportunities for product and market diversification and better access to markets.

As the "Strandzhanski manov med" Association is established and well-known, it (as a whole) or parts of it are suitable for a domain name. The latter has distinctive character and can also be used as a communication channel between beekeeping farms in Strandzha and the general society, and as a means for distribution of bee products. The domain name plays an important role in branding bee products from Strandzha on the Internet. It will strengthen the presence of beekeeping farms from Strandzha on the Internet and will provide favourable opportunities for personalization and building lasting relationships with the customers. The domain name improves innovativeness, competitiveness, and access to foreign markets.

The domain name plays an important role in branding bee products from Strandzha because it provides rich information in a fast and a cheap manner. The beekeeping farms from Strandzha can have an interactive dialogue with their partners and learn more about their desires and preferences.

They can customize their offers and messages, allowing for establishing closer relationships with customers from all parts of the world at very low costs.

The domain name does not limit the beekeeping farms from Strandzha within their geographical location. The domain name provides global access to building

- an image and loyalty to branded bee products, thus enabling successful use of marketing of relationships and customized marketing.

Local and online markets, short supply chains for bee products and api-tourism

- In the context of stronger competition on international markets for bee products and the EU membership, the beekeepers from Strandzha can achieve greater competitiveness at regional level when local markets³ and short supply chains⁴ of bee products exist, considering some of their advantages over national and international markets.

- The local markets and short supply chains for bee products provide benefits such as time reduction, realization costs and environmental pollution, formation of own markets, liquid realization without intermediaries.

- They stimulate the creation of bee products with high added value and improve the profitability, independence and food security of local communities.

- The local markets increase the incomes of beekeeping farms and stimulate the development of the local economy. They contribute to preserving the culinary traditions and the authentic foods and drinks from Strandzha. Through them, local communities have the opportunity to support regional producers of bee products. They also increase the awareness among producers and consumers, and provide better opportunities for the development of crafts, tourism, etc., thus creating events, culture and traditions at a local level. This creates a lasting relationship between producers and consumers of bee products, and foods and beverages based on them. They allow access to local bee products that are absorbed much better from people living in the area where the

bee products are produced.

The exacerbating competition on international offline markets creates conditions in which the beekeeping farms in Strandzha can build short supply chains and gain access to both local and global markets through the formation of online markets.

This will destroy the regional monopolies of the merchants and will improve the opportunities for liquid and profitable realization of beekeeping farms in Strandzha. It will stimulate the consumption of local organic and unique bee products produced in the region of consumption, as well as the development of regional infrastructure for transport, Internet and tourism related to beekeeping. The transition to a more flexible online infrastructure leads to saving costs and time for consumers, and reduces environmental pollution.

The online markets allow to reduce the labour-intensive business processes, and respectively – the cost of bee products. They provide access to new market segments for healthy products such as honey and pollen with PDO and compete with their less healthier substitutes – sugars and artificial sweeteners, thereby expanding the market for bee products.

Improving the realization through online markets will stimulate the development of beekeeping in Strandzha, pollination and preservation of biodiversity, sustainable agricultural practices and food security, as well as the development of organic beekeeping and organic farming, the protection of flora and fauna, and the responsible use of natural resources.

The online markets for bee products have a number of advantages over offline markets. The more important

advantages are: the ability for local and global sales in the absence of spatial barriers and the need for physical presence; better and sustainable growth prospects while reducing personnel costs, storage and environmental pollution; continuity of business processes from production to consumption; personalization and individualisation by building client databases; greater speed of supplies and customer self-service; faster market research and quicker realization; ability to lower prices and provide greater choice. By nature, online markets are more environmentally friendly than offline markets.

Beekeeping offers very good opportunities for the development of rural, wellness and other types tourism related to its activity and products, i.e. apitourism (Lyubenov, 2018a).

(Lyubenov, 2018a).

In addition to traditional bee products such as honey, wax, propolis, royal jelly and bee venom, which are widely used through apitherapy in balneology, spa and wellness services, apitourism provides opportunities for diversification of beekeeping by offering new products, hiking trails with visits to apiaries, museums with educational programmes, taking part in beekeeping activities and practices, tasting of bee products, foods, beverages, etc.

Apitourism provides opportunities for direct realization of bee products, accompanied by additional beekeeping services, resulting in an increase in the complex value and the added value of its products.

The interest in apitourism in the future will increase even more due to the desire of the contemporary society to live environmentally friendly, to eat ecologically clean, authentic and fresh local bee products combined with the opportunity to enjoy entertainment and

protect publicly important causes for preservation of bees and the environment.

Apitourism has the potential to significantly increase the consumption of regional bee products and other local products in the local economy of Strandzha because it forms local markets and short supply chains for bee products and services that diversify the incomes of farms in Strandzha. It has the ability to integrate the various local markets for the realization of bee products.

The different types of tourism, as well as the Internet, the improvement of transport, storage and other technologies-they all have a positive impact on the development of local markets and short supply chains for bee products from Strandzha, thus helping to break the monopoly of merchants. Such is the influence of the trend towards increasing the consumption of fresh, organic and unique local bee products produced in the region of consumption. Therefore, one of the main goals of beekeepers in Strandzha should be the development of apitourism and the realization of their products through local markets and short supply chains. This will diversify their incomes, and will allow the preservation of biodiversity and nature in Strandzha.

CONCLUSIONS

Marketing is the main engine for developing the potential of Bulgarian bee products, as well as those from Strandzha. It can significantly increase the sales of all the unique bee products from Strandzha.

Marketing will diversify and increase the incomes from beekeeping in Strandzha as well as the social and economic development of the whole region. It will help to better use its forestry potential while preserving its ecosystems through

increased pollination.

Marketing has a key role in the circular economy of beekeeping in Strandzha because it defines bee products, their design and production, as well as offline and online markets where they will be competitive. It encompasses all business processes from the choice of specific bee products from Strandzha, their branding and distribution that share the other marketing policies and strategy, to the social and economic development, biodiversity and ecological balance in region.

The relationship between Strandzha forestry, including natural and human factors, and the unique characteristics of its bee products, allows the beekeeping farms in Strandzha to form the PDO "Strandzhanski manov med" (Strandzha honeydew) and consequently- other intellectual products.

It is a unique and high-quality product that is not only of high added value but also legally protected, i.e. granting exclusive rights to its users, allowing for better market protection and realization.

The domain name is distinctive and can also be used as a communication channel between beekeeping farms in Strandzha and society, and as a means of distributing bee products. It suggests a certain quality, based on the image created, and the PDO "Strandzhanski manov med" guarantees it. Branding through a PDO and a domain name promotes the competitiveness of beekeeping farms in Strandzha and enables the development of rural and apitourism, as well as many other industries.

The association "Strandzhanski manov med" (Strandzha honeydew) is an integrator of the beekeeping farms in Strandzha. By its means, they carry out common strategy and marketing policies,

2021-2027

- which is a joint marketing that allows the
- application of the complete marketing
- toolset to products with high added value.
- Through association, the beekeeping
- farms have better opportunities for
- product and market diversification and
- better access to markets.

For the new programming period of the Common Agricultural Policy 2021-2027 of the EU, there is a strong need to include an EU-wide payment measure for the ecosystem pollination service. This is very important given the role of pollination in the circular economy. The domain name and online markets have an important role to play in the digitization and development of the beekeeping sector at global, national and regional level – Strandzha.

- The beekeepers in Strandzha have
- to develop apitourism and distribution
- through local markets and short supply
- chains because this will break the
- monopoly of merchants, will diversify their
- incomes, and will enable the preservation
- of biodiversity and nature in Strandzha.
- The penetration Internet, improving the
- transport, warehouse and other
- technologies – they all have a positive
- impact on the development of local and
- online markets and short supply chains for
- bee products from Strandzha.

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