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### **Efficacy of *Macleaya cordata* preparation in growing broiler chickens**

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Efektywność stosowania preparatu z *Macleaya cordata* (bokkonia sercowata) w  
żywieniu kurcząt brojlerów

**Summary.** The aim of this study was to determine the effect of *Macleaya cordata* preparation on the performance parameters and carcass characteristics of growing broiler chickens. The experiment was conducted during 35 days of the rearing period, and it involved Ross 308 broiler chickens kept in litter pens. A total of 2 640 sexed birds (50% males and 50% females) were randomly assigned to two treatments with 24 replicates per treatment: negative control (T1) and experimental treatment where diets were supplemented with *Macleaya cordata* preparation at 15 mg kg<sup>-1</sup> feed (T2). No significant impact of diet supplementation with *Macleaya cordata* preparation on the performance parameters of birds or carcass yield was observed. Our findings indicate that *Papaveraceae* alkaloids - the active ingredients of the phytogenic preparation Sangrovit<sup>®</sup> - had no influence on the analyzed parameters or exerted only a minor effect under experimental conditions. A similar test should be carried out under field conditions.

**Key words:** broiler chickens, phytobiotic, *Macleaya cordata*, performance, carcass yield

#### INTRODUCTION

In our previous experiments, a phytogenic feed additive (trade name Sangrovit<sup>®</sup>) comprising plants of the family *Papaveraceae* (the poppy family) and the alkaloid sanguinarine used as dietary supplements had no significant effects on fattening performance, carcass quality, nutrient digestibility, metabolizability of gross energy and N balance in growing turkeys and broiler chickens [Jeroch *et al.* 2009]. The phytogenic feed additive Sangrovit<sup>®</sup> had no beneficial influence on the performance, digestive processes and physiological parameters of broiler chickens [Kozłowski *et al.* 2008a, 2008b]. Another digestibility trial revealed that long-term administration of sanguinarine to broilers significantly inhibited fermentation processes in their ceca, thus reducing the production of volatile fatty acids in this section of the gastrointestinal tract [Jankowski *et al.* 2009]. Similar results were reported by Juśkiewicz *et al.* [2013] for broilers fed sanguinarine-supplemented diets. The above research findings are important from the perspective of

intestinal health. It should also be noted that other authors reported on significant and insignificant performance- or carcass quality-enhancing effects of this phytobiotic preparation [Damme and Ader 2004, Totilas *et al.* 2008, Vieira *et al.* 2008, Zduńczyk *et al.* 2010]. An objective assessment of Sangrovit<sup>®</sup> would require further tests, as shown by previous studies of feed antibiotic supplements [Hennig 1982, Meixner *et al.* 1986]. In experiments with antibiotics and, more recently, probiotics only numerical effects were determined [Meixner *et al.* 1986, Simon 2001]. The absence of statistically significant differences between the control and experimental groups could result from a too low number of replicates (a methodological error). Therefore, in the present experiment *Macleaya cordata* preparation was tested in broilers assigned to two treatment groups (control group, experimental group) of 24 subgroups each [Ruszczyc 1981].

The aim of this study was to determine the effect of *Macleaya cordata* preparation (Sangrovit<sup>®</sup>, Phytobiotics) on the performance of growing broiler chickens between 1 and 35 days of age.

#### MATERIALS AND METHODS

The experiment was conducted in one of the floor pen houses located at the Experimental Farm administered by the Department of Poultry Science, University of Warmia and Mazury (UWM) in Olsztyn, Poland. All procedures were approved by the Animal Care and Use Committee at the University of Warmia and Mazury. A total of 2 640 sexed broiler chickens of the Ross 308 strain were placed in 48 pens, with 55 birds per pen (approx. 50% males and 50% females). Each treatment consisted of 24 pens (24 replicates), with 1320 birds per treatment. Stocking density was approximately 16 birds m<sup>-2</sup>. The chickens were reared for five weeks on deep litter and were fed standard diets in meal form in a two-stage system (starter and grower/finisher). Control group (T1) birds received basal diets and experimental group (T2) birds received identical diets supplemented with *Macleaya cordata* preparation at 15 mg kg<sup>-1</sup> feed. The basal diets were formulated in accordance with the Polish feeding program [Smulikowska and Rutkowski 2005], and their composition and calculated energy and nutrient content are shown in Table 1. The diets, based on wheat, corn and soybean meal, were analyzed for the content of crude nutrients by the VDLUFA method [Naumann and Bassler 1993].

The birds had free access to feed and water throughout the experiment. The housing conditions conformed to the recommendations of the breeder company [Aviagen 2012]. Straw was used as bedding material.

All birds were weighed on a pen basis on day 1, and individually at 21 and 35 days of age. Feed intake was determined weekly and mortality rates were recorded daily. At the end of the experiment, birds representing the average body weight of males in each group were selected for carcass quality assessment (24 birds per treatment, 48 birds in total). Carcass weight (after 12 hours of chilling), the proportions of the bowels, breast meat without skin, thigh meat, drumstick meat and abdominal fat, and carcass yield were determined according to the method proposed by Ziotecki and Doruchowski [1989].

The results were verified statistically by one-way analysis of variance (ANOVA) in an orthogonal design. The significance of differences was estimated by Duncan's test. The calculations were performed using the Statistica software package ver. 10.0 [StatSoft Inc. 2011]. Data in tables are given as means and standard deviations.

## RESULTS

An analysis of experimental diets showed that they were nutritionally adequate (Table 1). All birds were characterized by high livability that ranged from 98.64% in treatment T1 to 98.86% in treatment T2. No significant differences in average body weight

Table 1. Composition and nutrient content of basal diets for broiler chickens (g kg<sup>-1</sup>)  
Tabela 1. Skład i zawartość składników pokarmowych pasz bazowych dla kurcząt brojlerów (g kg<sup>-1</sup>)

Components/ Komponenty	Starter (1–21 days/ dni)	Grower (22–35 days/ dni)
Wheat/ Pszenica	395.80	395.70
Corn/ Kukurydza	200.00	200.00
Soybean meal/ Poekstr. śruta sojowa	290.00	248.00
Rapeseed meal/ Poekstr. śruta rzepakowa	30.00	50.00
Potato protein/ Białko ziemniaczane	10.00	-
Soybean oil/ Olej sojowy	30.00	35.00
Animal fat/ Tłuszcz zwierzęcy	-	30.00
Limestone/ Kreda paszowa	15.00	14.00
MCP/ Monofosforan wapnia	15.00	13.00
NaHCO <sub>3</sub>	3.40	3.30
NaCl	1.40	1.40
Methionine/ Metionina	2.10	1.90
L-Lysine HCl/ L-Lizyna HCl	1.70	2.00
Threonine/ Treonina	0.30	0.90
Premix <sup>1</sup> / Premiks <sup>1</sup>	2.50	2.50
Choline-Cl/ Chlorek choliny	2.80	2.30
Energy and nutrient content <sup>2</sup> Energia i zawartość składników pokarmowych <sup>2</sup>		
AME <sub>N</sub> / EM <sub>N</sub> (MJ kg <sup>-1</sup> )	12.31	13.19
Crude protein/ Białko ogólne	221.3 <sup>3</sup>	200.1 <sup>3</sup>
Crude fiber/ Włókno surowe	33.6 <sup>3</sup>	32.8 <sup>3</sup>
Crude fat/ Tłuszcz surowy	45.6 <sup>3</sup>	77.9 <sup>3</sup>
Starch/ Skrobia	197.4 <sup>3</sup>	198.8 <sup>3</sup>
Sugars/ Cukry	9.4 <sup>3</sup>	7.6 <sup>3</sup>
Lysine/ Lizyna	12.1	11.0
Threonine/ Treonina	8.2	8.0
Methionine/ Metionina	5.3	4.9
Met + Cys	9.2	8.5
Sodium/ Sód	1.7	1.7
Calcium/ Wapń	9.7	8.9
Phosphorus/ Fosfor	5.0	4.6

<sup>1</sup> Supplied per kilogram of diet/ Suplementacja na kilogram paszy: vit. A 12000 IU; vit. D<sub>3</sub> 5000 IU; vit. E 30 mg; vit. K<sub>3</sub> 3 mg; vit. B<sub>1</sub> 2.2 mg; vit. B<sub>2</sub> 8 mg; vit. B<sub>6</sub> 5 mg; vit. B<sub>12</sub> 11 µg; folic acid 1.5 mg; biotin 150 µg; calcium pantothenate 25 mg; nicotinic acid 65 mg; Mn 60 mg; Zn 40 mg; I 0.33 mg; Fe 80 mg; Cu 8 mg; Se 0.15 mg; ethoxyquin 150 mg

<sup>2</sup> Calculated/ wartości obliczone [Smulikowska and Rutkowski 2005]

<sup>3</sup> Analyzed/ wartości analityczne [Naumann and Bassler 1993]

Table 2. Fattening performance of broiler chickens fed diets with or without *Macleaya ordata* supplementation  
Tabela 2. Wyniki odchovu kurcząt brojlerów żywionych paszą z dodatkiem lub bez dodatku *Macleaya cordata*

Parameter Cecha	Period, days Okres, dni	Treatment groups Grupy doświadczalne		P
		T1	T2	
Feed intake Spożycie paszy (kg)	1–21	1.100 <sup>b</sup> ±0.035	1.079 <sup>a</sup> ±0.028	0.030
	22–35	2.168 ±0.037	2.178 ±0.063	0.523
	1–35	3.259 ±0.063	3.243 ±0.061	0.361
Body weight Masa ciała (kg)	1	0.042 ±0.001	0.042 ±0.001	0.341
	21	0.784 ±0.024	0.775 ±0.033	0.278
	35	2.043 ±0.051	2.036 ±0.064	0.706
Body weight gain Przyrost masy ciała (kg)	1–21	0.742 ±0.024	0.733 ±0.032	0.288
	22–35	1.259 ±0.048	1.261 ±0.048	0.845
	1–35	2.001 ±0.051	1.994 ±0.064	0.717
Feed conversion ratio Zużycie paszy (kg kg <sup>-1</sup> )	1–21	1.497 ±0.039	1.486 ±0.053	0.678
	22–35	1.725 ±0.069	1.729 ±0.077	0.872
	1–35	1.641 ±0.048	1.644 ±0.620	0.838

Values in rows with different letters differ significantly; ab – P ≤ 0.05  
Średnie oznaczone różnymi literami różnią się istotnie; ab – P ≤ 0,05

Table 3. Carcass characteristics of broiler chickens fed diets with or without Sangrovit<sup>®</sup> supplementation  
Tabela 3. Charakterystyka tuszek kurcząt brojlerów żywionych paszą z dodatkiem lub bez dodatku preparatu Sangrovit<sup>®</sup>

Parameter Cecha	Treatment groups Grupy doświadczalne		P
	T1	T2	
Body weight before slaughter Masa ciała przed ubojem (kg)	2.18 ±0.04	2.17 ±0.03	0.432
Heart <sup>1</sup> / Serce <sup>1</sup> (%)	0.49 ±0.06	0.47 ±0.07	0.179
Gizzard <sup>1</sup> / Żołądek <sup>1</sup> (%)	1.20 ±0.13	1.15 ±0.12	0.188
Liver <sup>1</sup> / Wątroba <sup>1</sup> (%)	1.93 <sup>a</sup> ±0.16	2.04 <sup>b</sup> ±0.17	0.025
Carcass weight/ Masa tuszki (kg)	1.62 ±0.05	1.60 ±0.04	0.074
Dressing percentage <sup>1</sup> Wydajność rzeźna <sup>1</sup> (%)	74.39 ±1.51	73.64 ±1.42	0.082
Cold carcass weight Masa tuszki schłodzonej (kg)	1.60 ±0.05	1.58 ±0.04	0.074
Breast muscles <sup>2</sup> Mięśnie piersiowe <sup>2</sup> (%)	26.36 ±1.88	25.78 ±1.83	0.284
Thigh muscles <sup>2</sup> Mięśnie udowe <sup>2</sup> (%)	12.66 ±0.73	12.51 ±0.61	0.470
Drumstick muscles <sup>2</sup> Mięśnie podudzia <sup>2</sup> (%)	8.76 ±0.51	8.71 ±0.49	0.731
Abdominal fat <sup>2</sup> Tłuszcz sadełkowy <sup>2</sup> (%)	1.49 ±0.41	1.81 ±0.96	0.133

Values in rows with different letters differ significantly; ab – P ≤ 0.05  
Średnie oznaczone różnymi literami różnią się istotnie; ab – P ≤ 0,05

<sup>1</sup> Body weight before slaughter/ Masa ciała przed ubojem = 100%

<sup>2</sup> Cold carcass weight/ Masa tuszki schłodzonej = 100%

and in body weight gains were noted between treatment groups throughout the experiment (Table 2). At the end of the experiment, the average body weight of birds was similar in both treatment groups (2.043 kg – T1 and 2.036 kg – T2). No influence of dietary inclusion of *Macleaya cordata* preparation on body weight gains was observed over the entire experiment.

Table 4. Evaluation of the effects of some phytogetic feed additives in broilers  
Tabela 4. Wpływ wybranych dodatków fitogenicznych na kurczęta brojlery

Source Źródło	Tested substances Badane substancje	Dosage per kg of diet Dawka na kg paszy	Results Wyniki
Halle <i>et al.</i> [2004, 2008]	savory and oregano products cząber i produkty z oregano	3–20 g savory (cząber), 2–20 g oregano, 0.1–1 g oregano oil (olej z oregano)	FI <sup>1</sup> partly reduced, no or no significant effect on BW <sup>2</sup> and FCR <sup>3</sup> except for oregano oil: FCR significantly lower FI <sup>1</sup> częściowo obniżone, brak lub brak istotnego wpływu na BW <sup>2</sup> i FCR <sup>3</sup> , poza olejem z oregano: FCR istotnie niższe
Wald [2002]	essential oils of cassia, lemon grass, clove leaves, oregano, allspice leaves olejki eteryczne z cynamonu, trawa cytrynowa, liście goździków, oregano, liście ziela angielskiego	0.1 g	minor decrease in FI and BW, except for lemongrass oil, no effect on FCR and the fatty acid profile of abdominal fat niewielkie obniżenie FI i BW, z wyjątkiem oleju z trawy cytrynowej, brak wpływu na FCR i na profil kwasów tłuszczowych tkanki tłuszczowej
	oregano oil olej z oregano	0.1 g	no effect on FI, BW, FCR and the fatty acid profile of abdominal fat brak wpływu na FI, BW, FCR i profil kwasów tłuszczowych tkanki tłuszczowej
Westendarp <i>et al.</i> [2006]	monoterpenes from various essential oils (including oregano oil) monoterpeny z różnych olejków eterycznych (w tym olej z oregano)	52 mg carvacrol, 26 mg $\gamma$ -terpinene, 26 mg p-cymene-7-ol; mixture of three substances	no effect on FI, BW, FCR, N-balance, meat nutrient content and meat taste, significantly lower breast muscle weight in the $\gamma$ -terpinene group, the other supplements had no effect on carcass quality traits brak wpływu na FI, BW, FCR, bilans azotu, zawartość składników pokarmowych mięsa oraz smak mięsa, istotne obniżenie masy mięśni piersiowych w grupie $\gamma$ -terpinene, inne dodatki nie miały wpływu na cechy jakości tuszy

<sup>1</sup> FI – feed intake/ spożycie paszy

<sup>2</sup> BW – body weight/ masa ciała

<sup>3</sup> FCR – feed conversion ratio/ zużycie paszy

During the first experimental period (1–21 days), a significant difference in feed intake was noted between the groups – control group chickens consumed more feed than birds from the *Macleaya cordata* treatment group (Table 2). The above trend was not observed in the remaining experimental periods. The feed conversion ratio was identical in groups T1 and T2 (Table 2). There were no significant differences in carcass dressing percentage and the percentages of breast and leg muscles between the groups (Table 3). Birds from the *Macleaya cordata* treatment group were characterized by significantly ( $p \leq 0.05$ ) higher liver weight.

#### DISCUSSION

Bird performance parameters noted in our experiment are typical of the Ross 308 genotype [Aviagen 2012]. Diet supplementation with *Macleaya cordata* preparation had no significant impact on the performance parameters of birds or carcass yield and quality, which corroborates the results of a previous experiment with Ross broilers [Kozłowski *et al.* 2008a]. However, a significant difference of 2% in feed intake between the groups in the starter period indicates that *Macleaya cordata* could be an important feed additive, and more studies are needed to determine its value. Such a result could only be achieved in an experimental design involving a high number of replicates. The results of broiler trials with the use of the same phytobiotic preparation, obtained by other authors, are different. Damme and Ader [2004] reported a significant improvement in feed conversion in Ross broiler chickens. Moser *et al.* [2003] observed no significant differences with respect to fattening and carcass quality parameters of broilers between the control group and the group which received a Sangrovit® – supplemented diet.

Attention should also be paid to the significantly higher liver weight in the *Macleaya cordata* treatment group (T2), which has not been reported to date. Experimental designs with varied dosages of the tested preparation would be needed to determine whether the above effect could be attributed to the presence of alkaloids in *Macleaya cordata*.

Other experiments, whose results are summarized in Table 4, demonstrated no significant effects of phytochemical substances on broiler chickens. However, both numerical and significant performance improvements were reported in other animal species [Jeroch *et al.* 2009]. In general, the results of our experiment support previous research into the phytochemical feed additive Sangrovit®, and the findings of other studies performed in broilers and growing turkeys [Jankowski *et al.* 2009, Kozłowski *et al.* 2008a, b, Seskeviciene *et al.* 2005a, b, c, Totilas *et al.* 2008, Zduńczyk *et al.* 2010].

#### CONCLUSIONS

Based on previous research, *Macleaya cordata* preparation cannot be recommended as a feed additive for broiler chickens. Other phytochemical preparations showed no performance-enhancing effect in broilers, either. Our findings indicate that *Papaveraceae* alkaloids – the active ingredients of the phytochemical preparation Sangrovit® – had no influence on the performance parameters of broilers or carcass yield and quality, or exerted only a minor effect under experimental conditions. A similar test should be carried out under field conditions.

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**Streszczenie.** Celem badań było określenie wpływu preparatu z *Macleaya cordata* (bokkonia sercowata) na wyniki odchowu oraz wydajność rzeźną kurcząt brojlerów. Materiał doświadczalny stanowiły kurczęta brojlery Ross 308 utrzymywane do wieku 35 dni w kojcach na ściółce. Ptaki w liczbie 2640 seksowanych osobników (50% samców i 50% samic) podzielono losowo na dwie grupy (24 powtórzenia w każdej): grupa kontrolna (T1) i grupa doświadczalna (T2), w której pasza została uzupełniona preparatem z *Macleaya cordata* w dawce 15 mg kg<sup>-1</sup> paszy. Nie stwierdzono istotnego wpływu suplementacji paszy preparatem z *Macleaya cordata* na wyniki odchowu ptaków oraz na wydajność rzeźną kurcząt. Wyniki badań wskazują, że alkaloidy z rodziny roślin makowatych — aktywne składniki fitogenicznego preparatu Sangrovit® — nie wywarły wpływu na analizowane cechy lub ich wpływ był niewielki. Podobne badania należałoby przeprowadzić w warunkach produkcyjnych.

**Słowa kluczowe:** kurczęta brojlery, fitobiotyk, *Macleaya cordata*, wyniki odchowu, analiza rzeźna