

Efficacy of probiotic “ToyoCerin®” and phytobiotic “Cuxarom Spicemaster” on growing rabbits

**P. Matusevicius and H. Jeroch
Lithuanian Veterinary Academy, Kaunas, Lithuania**

Introduction

Until the final ban on antibiotic feed additives in the EU which took effect on 01.01.2006 (EU regulation no. 1831/2003) these feed additives were also added to rabbit feed. Amongst other things they were used to reduce the occurrence of diarrhoea following weaning which is a major cause of losses in commercial rabbit production (TETENS, 2007). As alternatives for antibiotic feed additives FALCAO-E-CUNHA *et al.* (2007) and others discuss probiotics, prebiotics, enzymes as well as organic acids and critically evaluate the literature available concerning growing rabbits. On various occasions phytogetic preparations (phytobiotics, botanicals) are also named as possible alternative substances (e.g. WENK, 2005).

In comparison to pigs and poultry far less scientific publications are available concerning possible alternatives for use in rabbits (FALCAO E-CUNHA *et al.*, 2007). In order to evaluate these substances as supplements in rabbit feed, further trials are urgently needed, as FALCAO E-CUNHA *et al.* (2007) conclude from their literature review. Therefore trials were carried out with the probiotic preparation ToyoCerin® and the phytobiotic preparation Cuxarom Spicemaster. The results are presented below and compared with similar data found in the literature.

Own trials

Materials and methods

Using the preparations ToyoCerin® and Cuxarom Spicemaster 2 trials (1, 2) were carried out in succession, each trial consisting of 3 groups:

- Group I: commercial feed for rabbits with no supplements (control group)
- Group II: commercial feed as group I plus 100 mg ToyoCerin®/kg feed,
- Group III: commercial feed as group I plus 300 mg Cuxarom Spicemaster/kg feed.

In trial 1 each group consisted of 9 animals, while 11 animals were allocated to each group in trial 2. The trial duration was 56 days for each trial.

Both trials were carried out using New Zealand white rabbits. In trial 1 young rabbits reproduced at the Institute and weaned at the age of 30 days were used. For trial 2 the animals were acquired from a commercial rabbit farm. At the beginning of the trial they were 8 weeks old and thus had a higher body weight in comparison to trial 1.

The probiotic preparation ToyoCerin® contains spores of *Bacillus cereus var. toyoi* at a concentration of 1×10^{10} cfu/g. The phytogetic feed additive Cuxarom Spicemaster is a mixture of brown algae, several herbs and spices (basil, fennel, garlic, cinnamon) and essential oils (aniseed, thyme). The dosage of both trial preparations per kg feed was in accordance with the recommendations of the contract partner Lohmann Animal Health, Cuxhaven, Germany.

The feed mixtures were manufactured in the compound feed plant UAB “Krekenavos pasawai”, Krekenava/Lithuania. The mineral feed for the feed mixtures for the 3 groups (control / with ToyoCerin® / with Cuxarom Spicemaster) were produced by Basu-Mineralfutter GmbH in Bad Sulza/Germany. The composition of the feed was the same for all 3 groups in both trials. It consisted of the following components (per kg mixture): 174.0 g ground barley, 135.7 g ground oats, 90.0 g wheat bran, 165.0 g sunflower seed meal, 80.0 g soybean meal, 50.0 g dried sugar beet pulp, 260.0 g dried grass meal, 25.3 g mineral compounds, 20.0 g mineral feed (minerals, trace elements, vitamins, tested

additives (groups II and III)). The following nutrients and energy contents in the mixtures (per kg with 88% dry matter) were calculated (MAERTENS *et al.*, 2002): 170 g crude protein, 24 g crude fat, 126 g crude fiber, 329 g neutral detergent fibre, 156 g starch, 49 g sugar, 9.93 MJ digestible energy.

The trials were carried out in the vivarium of the Lithuanian Veterinary Academy, Kaunas, i.e. under laboratory conditions. The animals were kept in single cages of a two-deck battery. The trial room was partly air-conditioned. The rabbits were offered the feed in pellet form (4 mm diameter) via automatic feeders *ad libitum*. Water in drinking-water quality was permanently available via nipple drinkers.

The following data were collected:

- Health status (diarrhoea incidence etc.), losses and possible causes,
- Individual live body weight at the beginning and at the end of each trial,
- Individual feed intake by weighing the amount of feed offered at the beginning of the trial and the amount left at the end of the trial,
- Carcass characteristics of all rabbits of trials 1 and 2 at the end of the trial (DLG-Scheme; PETERSEN, 2004),
- Meat quality parameters for the back and the legs of all carcasses (trial 1).

The feed conversion ratio (kg feed per kg weight gain) was calculated from feed intake and live weight gain. The program STATISTIKA for WINDOWS (STATSOFT, INC., 2007) was used for the statistical evaluation of the trial results.

Results

No problems occurred in either trial. No signs of diarrhoea were determined in any of the animals. No losses occurred which is most likely due to the ideal housing conditions.

The data on fattening performance are shown in table 1. In trial 1 the animals of all 3 groups ate virtually the same amount of feed. In contrast to this, the two feed additives in trial 2 caused a higher intake of feed (by 5% group II, Toyocerin® respectively 7.5% group III, Cuxarom Spicemaster), which, however, is not statistically significant due to the considerable variance between animals in the same group. In both trials the probiotic and phytobiotic feed additives improved the growth of the animals, whereby the effect of Cuxarom Spicemaster (phytobiotic) was even stronger than that of Toyocerin® (probiotic).

Table 1: Feed intake, live weight gain and feed conversion ratio during the trials

Trial	Group	Feed intake g/animal	Initial live weight g/animal	Final live weight g/animal	Weight gain g/animal	Feed conver- sion ratio kg feed/ kg gain
1	I (Control)	6906	1034	2807 ^a	1773 ^a	3.90 ^a
	II (ToyoCerin®)	6971	1067	2937 ^{ab}	1870 ^{ab}	3.73 ^{ab}
	III (Spicemaster)	6820	1071	2992 ^b	1921 ^b	3.55 ^b
2	I (Control)	5644	1927	3274 ^a	1347 ^a	4.19
	II (ToyoCerin®)	5918	1948	3413 ^b	1465 ^b	4.04
	III (Spicemaster)	6074	1938	3456 ^b	1518 ^b	4.00

Averages with different superscripts (a, b) differ significantly (P<0.05)

In trial 2 the effects of the feed additives were even more evident than in trial 1, although the animals were older at the beginning of the trial. The feed conversion ratio was reduced by both feed additives. With this parameter also, the phytogenic preparation demonstrated higher efficacy than the probiotic, and the reduction in the feed conversion ratio was slightly higher in trial 1 in comparison to trial 2. On the whole, however, the differences in this parameter between the control group (I) and trial groups (II, III) are not statistically significant.

The carcass weight as well as the weight of the valuable carcass parts increased as a result of both feed additives analogously to the increase in live weight at the end of the trial (see table 2). However, the differences in comparison to the control group are only significant in part. In contrast to this, the slaughter yield (%) and the percentage in carcass composition changed only slightly.

Table 2: Results of the carcass analysis

Trial	Group	Slaughter weight g/animal	Yield % ¹	Foreparts		Back		Thighs	
				g	% ²	g	% ²	g	% ²
1	I (Control)	1573 ^a	56	447	28	603	38	522 ^a	33
	II (ToyoCerin)	1639 ^{ab}	56	477	29	602	37	569 ^b	35
	III (Spicemaster)	1717 ^b	57	507	30	638	37	572 ^b	33
2	I (Control)	1774 ^a	54	497	28	636 ^a	36	641	36
	II (ToyoCerin)	1886 ^{ab}	55	563	30	666 ^a	35	658	35
	III (Spicemaster)	1929 ^b	56	547	28	713 ^b	37	675	35

Averages with differing superscripts (a,b) show significant differences (P<0.05)
¹ based on the live weight (empty) ² based on slaughter weight

The additives tested had no influence on the chemical composition of the back and thigh meat.

Discussion

In both trials ToyoCerin® improved growth and feed conversion ratio, although the results were only significant in part. As no digestive disorders could be determined and no losses occurred, it is not possible to make any statements on the influence of ToyoCerin® on the health status of the animals. Other experiments on young rabbits have been carried out over the last few years with the same probiotic preparation. The information on the influence on growth, feed conversion ratio and mortality is shown in table 3. The results obtained differ substantially, ranging from no effect to an improvement in performance similar to that achieved in our experiments. Only one study reports a considerable decrease in the mortality rate (PASCUAL *et al.*, 2008). KRIEG and RODEHUTSCORD (2004) found no influence of ToyoCerin® on the level of animal losses nor on the share of animals showing symptoms of diarrhoea; they observed, however, that the average duration of the diarrhoea was clearly reduced. In a literature study by FALCAO-E-CUNHA *et al.* (2007) including a total of 20 experiments with various probiotic preparations, positive effects of probiotics on live weight gain, feed conversion ratio and mortality are predominant, but the effects differ substantially (weight gain increased by 1-13%, feed conversion ratio improved by 1-17%, and mortality was reduced by 2-17 percentage points).

In both trials the phytobiotic preparation Cuxarom Spicemaster considerably improved growth and feed conversion ratio, with the efficacy being slightly superior to the probiotic product ToyoCerin® which was tested at the same time. Only KRIEG and RODEHUTSCORD (2004) also tested this feed additive on rabbits (table 4); there was no positive effect on weight gain and feed conversion ratio (the differences in comparison to the control group were insignificant). Thyme oil, a component of

Table 3: Results reported in the literature with the probiotic ToyoCerin® on growing rabbits

Authors	Toyo-Cerin® Dose /kg feed	Trial condition	Differences compared to control group (in %)		Reduction in mortality % points
			Live weight gain	Feed conver- sion ratio	
ESTEVE- GARCIA <i>et al.</i> (2005)	0.2/0.5/ 1.0 g	Laboratory	+1 to +3	-2 to +4	Not specified
KRIEG and RODEHUTS- CORD (2004)	0.1 g	Field study	+1	-4	Not specified
PASCUAL <i>et al.</i> (2008)	1.0 g	Laboratory	No effect	No effect	-6
TROCINO <i>et al.</i> (2005)	0.2/1.0 g	Field study	+4 to +5	-3 to +4	Not specified

Cuxarom Spicemaster (table 4), also demonstrated virtually no influence on the named parameters. However, both additives had a positive effect on the health status of the animals (fewer days with diarrhoea, less animal losses as a result of *E.coli*).

The trial results with further phytobiotic preparations (see table 4) vary significantly. The summary table shows results reaching from considerable effects to insignificant or no improvement in performance and even negative effects. GUGOLEK *et al.* (2006) report a considerable reduction in losses (from 13% to 7%) after supplementing the fattening feed with the phyto-genic preparation DIAROAK (a mixture of *Andrographis paniculata*, *Holarrhena antidysnteria*, *Punica granatum* and *Berberis aristata*). In all other studies shown in table 4 – with the exception of the article by KRIEG and RODEHUTSCORD (2004) – no indication of improved health status of the animals after supplementing the feed with herbal preparations can be found.

The positive effects of both substances tested can also be observed from the slaughtering data. A comparison with the data in the literature, however, is not possible as virtually no appropriate data were collected at the end of the growth trials. Only JEROCH *et al.* (2009) report on numerically increased slaughter and carcass part weights as a result of the herbal feed additive Sangrovit®.

Conclusions

Both preparations showed positive effects under laboratory conditions. The results obtained for the probiotic preparation „ToyoCerin®“ again confirm that probiotics can be used as a feed additive in growing rabbits as an alternative to feed antibiotics. In order to give a final evaluation on the phyto-genic product “Cuxarom Spicemaster” further trials are needed, particularly trials carried out under field conditions. Laboratory trials generally do not provide any information on the effects on the health status of the animals.

Table 4: Results published with phyto-biotic substances in growing rabbits

Authors	Preparation	Trial condition	Differences in comparison to the control group (%)	
			Live weight gain	Feed conversion ratio
CHRASTINOVA <i>et al.</i> (2005)	XTRACT (Essential oil extract of capsicum, cinnamaldehyde and oregano)	Institute	-5 to +12	-8 to +9
ERDELYI <i>et al.</i> (2008)	Essential oils of <i>Rosmarinus officinalis</i> and <i>Allium sativum</i>	Institute	+0.5 to +5.0	-4 to 10
GUGOLEK <i>et al.</i> (2006)	DIAROAK (mixture of <i>Andrographis paniculata</i> , <i>Holarrhena antidysenteria</i> , <i>Punica granatum</i> and <i>Berberis aristata</i>)	Field study	+7	Not specified
JEROCH <i>et al.</i> (2009)	<i>Papaveraceae</i> -Preparation (contains sanguinarine and other alkaloids)	Laboratory	+2	0 to -2
		Field study	+1.0 to +3.5	No effect
KRIEG and RODEHUT-SCORD (2004)	Spicemaster	Field study	-2.5	+2.5
	Thyme oil		No effect	-1
SIMONOVA <i>et al.</i> (2008)	Dry extract of <i>Eleutherococcus sentiosus</i>	Laboratory	+20	-2
ZOCCARATO <i>et al.</i> (2008)	Castanea sativa extract	Laboratory	+9 to +10	-6

Summary

In 2 performance trials, each consisting of 3 groups of New Zealand white rabbits, the effects of the probiotic product ToyoCerin® (spores of *B. cereus* var. *toyoi*) and the phyto-biotic product Cuxarom Spicemaster (brown algae mixed with the herbs and spices basil, fennel, garlic and cinnamon and essential oils of aniseed and thyme) were tested on the fattening performance and carcass characteristics of the animals. Each group comprised 9 (trial 1) or 11 (trial 2) animals, respectively, kept in single cages. In the 56-day trials (commencing after weaning at 30 days in trial 1 and at 8 weeks in trial 2) the growth of the animals and the feed conversion ratio improved considerably as a result of the two additives tested in comparison to the control groups. The additives also had a positive effect on the weight of the carcass and the parts thereof. However, not all effects of the preparations tested are statistically significant.

Zusammenfassung

In 2 Leistungsversuchen mit jeweils 3 Gruppen Mastkaninchen der Rasse Weiße Neuseeländer wurde die Wirksamkeit des probiotischen Präparates „ToyoCerin®“ (Sporen von *B. cereus* var. *toyoi*) und des phyto-biotischen Präparates „Cuxarom Spicemaster“ (Mischung aus einer Braunalge mit den Kräutern Basilikum, Fenchel, Knoblauch und Zimt sowie den ätherischen Ölen von Anis und Thymian) auf Mastleistung und Schlachtkörpermerkmale geprüft. Jede Gruppe bestand aus 9 (Versuch 1) bzw. 11 Tieren (Versuch 2) in Einzelkäfighaltung. In den 56 Tage dauernden Versuchen (Beginn nach dem Absetzen mit 30 Tagen im Versuch 1 und mit 8 Wochen im Versuch 2) wurden im Vergleich zur Kontrollgruppe das Wachstum der Tiere und der Futteraufwand durch beide geprüften Zusätze

verbessert. Auf die Gewichte der Schlachtkörper und deren Teilstücke hatten die Zusätze gleichfalls einen positiven Effekt. Nicht alle leistungsverbessernden Wirkungen der Prüfpräparate sind jedoch signifikant.

Key words: rabbits, probiotics, phytobiotics, growth, feed conversion ratio, carcass composition

Literature

- CHRASTINOVA, Lubica., CHRENKOKA, Maria, RAFAY, J., ONDRUSKA, L., SOMMER, A. (2005): Plant feed supplements in rabbits nutrition. Tagungsband 4. BOKU-Symposium, 27. Oktober in Wien, 164-167.
- ERDELYI, M., MATIC, ZS., GERENCSE, ZS., PRINCZ, Z., SZENDRŐ, ZS., MEZES, M. (2008): Study of the effect of rosemary (*Rosmarinus officinalis*) and garlic (*Allium sativum*) essential oils on the performance of rabbit. Proc. 9th World Rabbit Congress, June 10-13, 2008, Verona-Italy, 649-653.
- FALCAO-E-CUNHA, L., CASTRO-SOLLA, L., MAERTENS, L., MAROUNEK, M., PINHEIRO, V., FREIRE, J., MOURAO, J.L. (2007): Alternatives to antibiotic growth promoters in rabbit feeding: a review. *World Rabbit Sci.* 15, 127-140.
- ESTEVE-GARCIA, E., RAFEL, O., JIMENEZ, G. (2005): Eficacia de Toyocerin® en Conejos de engorde. Proc. XXX Symposium de Cuicultura de Asescu, Villadolid, 85-89.
- GUGOLEK, A., LIPINSKI, K., HARTMAN, Areta, KLEWSKA, Anna (2006): Effects of a herbal additive on the production results of New Zealand White rabbits. *Pol. J. Natural Sciences, Suppl. No 3/2006*, 615-620.
- JEROCH, H., KOZLOWSKI, K., LIPINSKI, K., JEROCH, Jolanta., ZDUNCZYK, Z., JANKOWSKI, J. (2009): Wirkung des phyto-genen Papaveraceae-Präparates Sangrovit® bei wachsenden monogastrischen Nutztieren. *Züchtungskunde* 81(4), 279-293
- KRIEG, R., RODEHUTSCORD, M. (2004): Kaninchen: Einsatz ausgewählter Futterzusatzstoffe. *DGS-Magazin, Woche 14*, 51-54.
- MAERTENS, L., PEREZ, J.M., VILLAMIDE, M., CERVERA, C., GIDENNE, T., XICCATO, C. (2002): Nutritive value of raw materials for rabbits: ERGAN tables 2002. *World Rabbit Science* 10 (4), 157-166.
- PETERSEN, J. (2004): Handbuch zur Kaninchenfleischgewinnung. Verlag Oertel & Spörer Reutlingen.
- PASCUAL, J.J., MOYA, V.J., MARTINEZ, E., CALVO, M.A., ADELANTADO, C., JEMINEZ, G., BLANCH, A., CASTILLO, M. (2008): Effects of dietary inclusion of toyocerin® (*Bacillus cereus* var. *toyoi*) on performance, health and faecal nitrogen excretion in growing rabbits. Proc. 9th World Rabbit Congress, June 10-13, 2008, Verona-Italy, 781-785.
- SIMONOVA, M., SZABOVA, R., CHRASTINOVA, L., LENKOVA, A., HAVIAROVA, M., STROPFOVA, V., PLACHA, I., FAIX, S., VASILKOVA, Z., MOITO, J., RAFAY, J. (2008): The use of ginseng extract in rabbits. Proc. 9th World Rabbit Congress, June 10-13, 2008, Verona-Italy, 809-813.
- STATSOFT INC., 2007: Statistica (data analysis software system), version 8. www.statsoft.com.
- TETENS, Martina (2007): Intensive Kaninchenhaltung in Deutschland. Dissertation Tierärztliche Hochschule Hannover.
- TROCINO, A., XICCATO, G., CARRARO, L., JIMENEZ, G. (2005): Effect of diet supplementation with toyocerin® (*Bacillus cereus* var. *toyoi*) on performance and health of growing rabbits. *World Rabbit Sci.* 13, 15-26.
- WENK, C. (2005): Einsatz von Kräutern und deren Extrakten in der Tierernährung: Erwartungen und Möglichkeiten. Tagungsband 4. Boku-Symposium Tierernährung, 27. Oktober 2005 in Wien, 17-27.
- ZOCCARATO, I., GASCO, L., SCHIAVONE, A., GUO, K., BARGE, P., ROTOLO, L., SAVARINO, G., MASOERO, G. (2008): Effect of extract of chestnut wood inclusion (ENC®) in normal and low protein aminoacid supplemented diets on heavy broiler rabbits. Proc. 9th World Rabbit Congress, June 10-13, 2008, Verona-Italy, 873-877.

Acknowledgements

We wish to express our thanks to Lohmann Animal Health GmbH, Cuxhaven, for supporting the trials and to BASU Mineralfutter GmbH, Bad Sulza, Germany and UAB "Krekenavos pasawai", Krekenava, Lithuania, for manufacturing the mineral feed and feed mixtures.

Authors' Address:

Assoc. Prof. Dr. P. Matusevicius and Prof. Dr. Dr.h.c. Heinz Jeroch,
Lithuanian Veterinary Academy
Tilzes g. 18, LT-47181 Kaunas, Lithuania
E-mail: paulmat@lva.lt