

# INVESTIGATION OF THE EFFECT OF *Tribulus terrestris* EXTRACT ON SOME CHARACTERISTICS OF THE REPRODUCTIVE CAPACITY OF GUINEA FOWL

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**Abstract:** The effect of Bulgarian product Vemoherb-T (dry extract of *Tribulus terrestris*) on some characteristics of the reproductive capacity of Guinea fowl (*Numida meleagris*) was studied. A trial was conducted with 30 Pearl-gray Guinea fowls, at the age of 32 weeks, divided in two groups, 12 female and 3 male each. The birds from the two groups were fed the same mixture. The experimental group received the tested product once daily in a dose 10 mg/kg body weight for 12 weeks. The laying intensity, egg morphology and fertility, the weight of testes and ovaries were controlled. It was found a higher laying intensity ( $P<0.05$ ), similarly higher egg weight ( $P<0.001$ ), yolk weight ( $P<0.01$ ), left testes weight ( $P<0.05$ ) and egg fertility in the experimental group. No significant differences about egg white weight and yolk color between the both groups were found.

**Key words:** Guinea fowl, *Tribulus terrestris*, egg production, egg fertility

## Introduction

The use of synthetic hormones as stimulators of reproductive performance in animal husbandry practice has a negative cumulative effect in animal products meant for the market. Therefore, their further use is not preferable because of the detrimental effect on human health. An alternative of synthetic hormones is the use of plant extracts. They are seen as natural feed additives, have been generally proven effective, non-toxic and well accepted by the public. Plants can produce phytochemicals with sex enhancing potency, able to stimulate reproductive performance of animals and birds. *Semerdjiev et al. (2008)* reported a positive effect of the product “Xtract” (multifunctional feed additive, which contains the following plant substances: Capsacin, cinnaldehyde and calvacrol) on egg fertility in hens. Bulgarian nutritional additive “Ovocap”, which contains capsacin, carotene and other biologically substances improved the reproductive parameters in cows (*Petkova et al., 2008*) hens and turkeys (*Kitanov et al., 2003*).

The extract of the herb *Tribulus terrestris* is one of the most popular phytoproducts, which contains saponins of the furostanol type, termed protodioscin. During the recent years experiments with various farm animals (rams, pigs, cocks, rabbits) proved the beneficial effect of *Tribulus terrestris* extract on sperm quality, sexual behavior and fertilizing ability of sperm. However, there are no reports in the available literature concerning the effect of *Tribulus terrestris* extract on other fowl species (except hens).

The aim of this work was to investigate the influence of the product Vemoherb T (dry extract of *Tribulus terrestris* L), produced by Vemo Ltd, Sofia, Bulgaria on some characteristics of breeder Guinea fowls reproductive capacity.

## Materials and Methods

The present study was carried out in the period April-June - 2008 at the Experimental center of Animal Science Department, Agricultural University - Plovdiv with 30 Pearl gray Guinea fowls at the age of 32 weeks, raised under extensive conventional method of production on a deep litter pen. The poultry were randomly divided in two groups – control and experimental, 12 female and 3 male each. The trial lasted 13 weeks – one week adaptation and 12 weeks experimental period. All birds received the same mixture for breeder Guinea fowls, containing 17.17% crude protein, 4.21% crude fat, 5.41% crude fibre and 11.80MJ/kg metabolizable energy. The nutritive value of the diet was determined by the Weende method. The experimental diet was supplemented with Bulgarian product Vemoherb-T in a dose of 10mg/kg body weight for a period of 12 weeks.

Daily laying intensity and capacity were controlled throughout the trial. Forty eggs from each group, laid within a few consecutive days were taken at the beginning, in the middle and at the end of the experimental period and following measurements were made:

- Egg weight, egg shell with the shell membrane taken as whole and egg yolk were measured with electronic scales OHAUS – 2000 within 0.01g.

- The egg white weight was determined for greater precision in the following way: the sum of the shell weight and the yolk weight was deducted from the value of the egg weight.

- Form index was calculated by the formula:  $i=d/D \times 100$ , where d is the small egg diameter and D – the big egg diameter.

- Haugh unit was calculated by the formula:  $HU=100lg(h + 7.17 - 1.7W^{0.37})$  using his method (1937), where h is the height of the thick glair (in mm); W – the egg weight.

- The shell thickness (in mm) without the shell membrane was measured by a micrometer Amer 25EE.

- The color of the yolk was measured visually (according to the 15 Roche Color Fan having 15 degrees scale)

One hundred and twenty eggs from each group taken at the beginning (II weeks) in the middle (VI weeks) and at the end (XII week) of the experimental period were incubated by 37.7-37.8° C and 60% relative humidity. Egg fertility was established on the 7<sup>th</sup> day of the embryonic development by ovoscopying.

The established data were statistically processed using Soft Ware product Excel 7f.

## Results and Discussion

The data about average value of laying intensity and laying capacity is pointed in Table1. Figure1 shows the dynamics of laying intensity in Guinea fowls throughout the experiment. The treated group had higher overall laying intensity ( $P<0.05$ ) and higher average value of laying capacity across the experimental period. The obtained results are in agreement with the data of other authors (*Surdjiiska et al., 2005*), who observed a tendency to increase the laying intensity ( $P>0.05$ ) in hens given *Tribulus terrestris* extract once daily with the diet in a dose 10mg/kg body weight for 20 days. At 7<sup>th</sup> and 8<sup>th</sup> weeks the experimental birds had lower laying intensity than in control group. *Grigorova (2008)* reported similar data in hens, receiving the same dose *Tribulus* extract with the diet for 11 weeks. The lower laying intensity in the experimental group at 7<sup>th</sup> and 8<sup>th</sup> weeks relative to control group could be due to physiological fatigue of the ovaries caused by the supplemental *Tribulus terrestris*.

**Table 1. Laying capacity and laying intensity in control and experimental groups ( $\bar{x} \pm SE$ )**

Period	Control group		Experimental group	
	Laying capacity egg number/hen	Laying intensity (%)	Laying capacity egg number/hen	Laying intensity %
Adaptations period	35.37	29.71	36.05	30.28
Experimental period	55.67	66.17±2.55	67.33***	71.10±2.65*

Significant: \*\*\* -  $P<0.001$ ; \*\* -  $P<0.01$ ; \* -  $P<0.05$

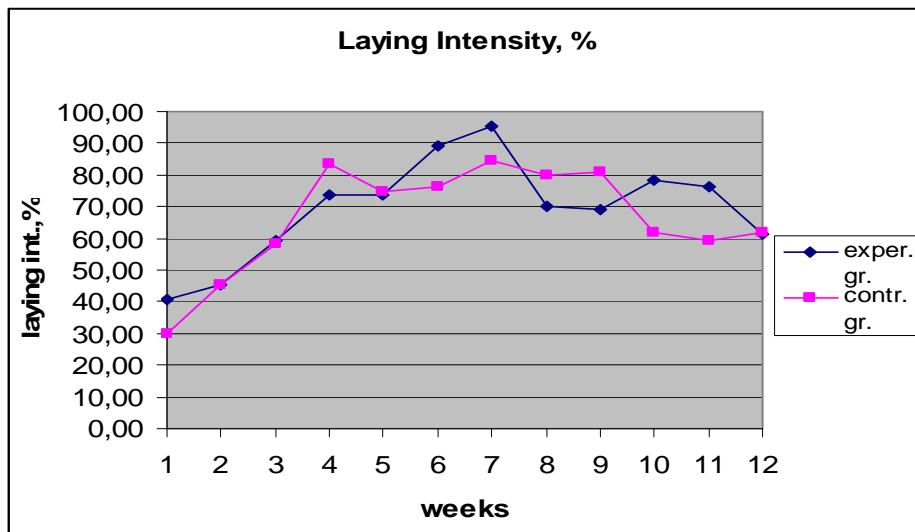


Figure 1. Laying intensity of Guinea fowls from control and experimental groups, %

Eggs morphological characteristics of the both groups are presented in Table 2 and in Table 3. The egg weight in the experimental group was higher ( $P < 0.001$ ) throughout the whole trial than in control group. The treated group had higher yolk weight at the middle ( $P < 0.01$ ) and at the end ( $P < 0.001$ ) of the trial. There are no significant difference in the data about the egg white weight and yolk color between the controls and the experimental groups. At the end of the trial was observed the higher value of HU ( $P < 0.05$ ) in experimental birds, than in control group. At the end of experimental period was found the increase of shell weight ( $P < 0.001$ ) and thickness ( $P < 0.001$ ) in treated birds in relation to the control group. Probably the increased values of the above parameters are due to the effect of the main improvement of the ovary activity and overall stimulation of vitality and metabolism (Tomova, 1987).

The egg fertility and the weight of reproductive organs of the birds from the both groups are pointed in Table 3. The very fact that the experimental birds had 7.1% higher percent of fertile eggs, suggests that *Tribulus terrestris* had a positive effect, but its share on male and female birds is not quite clear yet. Our preliminary data indicating higher testes weight in experimental Guinea fowl cocks suppose that the effect of *Tribulus terrestris* is more pronounced in cocks. This fact is consistent with the finding that fertility established inheritance is transmitted through the father (Pimenov et al., 1983). An improvement of egg fertility in hens receiving 10 mg/kg body weight *Tribulus terrestris* established by other authors (Kashamov, 2008; Surdjiiska et al., 2005) too.

**Table 2. Egg weight and form index in control and experimental groups ( $\bar{x} \pm SE$ )**

Items	Control group			Experimental group		
	Start of exp.	Midle of exp.	End of exp.	Start of exp.	Midle of exp.	End of exp.
Egg weight, g	40.28±0.22 a <sub>1</sub>	40.92± 0.22 a <sub>2</sub>	39.61± 0.20 a <sub>3</sub>	40.72±0.25a <sub>1</sub>	43.80± 0.22 a <sub>2</sub>	42.37± 0.33 a <sub>3</sub>
Form index	74.44±0.29 c <sub>1</sub> A <sub>1</sub> B <sub>1</sub>	75.57± 0.20 a <sub>4</sub> B <sub>1</sub> B <sub>2</sub>	76.37± 0.20 c <sub>2</sub> A <sub>1</sub> B <sub>2</sub>	73.72±0.25 c <sub>1</sub> A <sub>2</sub>	73.95±0.33 a <sub>4</sub> A <sub>3</sub>	75.57± 0.27 c <sub>2</sub> A <sub>2</sub> A <sub>3</sub>

Significant: a, A - P<0.001; b, B - P<0.01; c, C - P<0.05

**Table 3. Egg white weight, Haugh Units, yolk weight, yolk color (Roche), Egg shell weight and egg shell thickness in control group and experimental group ( $\bar{x} \pm SE$ )**

Items	Control group			Experimental group		
	Start of exp.	Midle of exp.	End of exp.	Start of exp.	Midle of exp.	End of exp.
Egg white weight, g	20.17± 0.35	21.05± 0.51	20.42± 0.42	20.24± 0.27b <sub>1</sub>	22.62± 0.80b <sub>1</sub> c <sub>3</sub>	20.44± 0.46c <sub>3</sub>
Egg white, %	51.00± 0.67	51.48± 0.89	51.03± 0.29b <sub>2</sub>	51.05± 0.53	51.91± 0.84B <sub>3</sub>	48.91± 0.56b <sub>2</sub> B <sub>3</sub>
Haugh Units	94.61± 0.64	93.82± 0.41	94.20± 0.53c <sub>4</sub>	95.18± 0.30	94.79± 0.44	95.62± 0.41c <sub>4</sub>
Yolk weight, g	11.96± 0.14	12.00± 0.22	11.85± 0.43b <sub>3</sub>	12.11± 0.14A <sub>4</sub> B <sub>4</sub>	12.70± 0.21 B <sub>4</sub>	13.19± 0.23 b <sub>3</sub> A <sub>4</sub>
Yolk, %	29.30± 0.35	29.80± 0.41	29.83± 0.38 b <sub>4</sub>	29.69± 0.34	28.94± 0.73B <sub>5</sub>	31.61± 0.50b <sub>4</sub> B <sub>5</sub>
Yolk color Roche	12.04± 0.22 A <sub>5</sub> A <sub>6</sub>	10.80± 0.27 A <sub>5</sub> C <sub>1</sub>	9.88± 0.30 A <sub>6</sub> C <sub>1</sub>	12.06± 0.19 A <sub>7</sub> A <sub>8</sub>	10.91± 0.22 A <sub>7</sub> B <sub>6</sub>	9.76± 0.25 B <sub>6</sub> A <sub>8</sub>
Egg shell weight, g	8.11± 0.15	7.83± 0.17	7.61± 0.18 a <sub>5</sub>	8.17± 0.12	8.18± 0.12 A <sub>9</sub>	8.84± 0.16a <sub>5</sub> A <sub>9</sub>
Egg shell, %	19.62± 0.31	18.66± 0.37	19.10± 0.45	19.02± 0.25	19.15± 0.23	19.40± 0.32
Egg shell thickness	0.54± 0.007	0.52± 0.007a <sub>6</sub>	0.54± 0.007a <sub>7</sub>	0.54± 0.007	0.54± 0.008a <sub>6</sub>	0.56± 0.006 a <sub>7</sub>

Significant: a, A - \*\*\* - P<0.001; b, B - \*\* P<0.01; c, C - \* P<0.05

**Table 4. Egg fertility and weight of reproductive organs ( $\bar{x} \pm SE$ ) in control and experimental groups**

Period	Control group		Experimental group		
	Eggs, n	Fertility, %	Eggs, n	Fertility, %	
Beginning of the trial	120	84.47	120	92.86*	
Middle of the trial	120	89.74	120	97.37	
End of the trial	120	89.19	120	95.16	
Total	360	88.04	360	95.14***	
Weight of reproductive organs					
Control group			Experimental group		
Ovary n=6	Right testis n=3	Left testis n=3	Ovary n=6	Right testis n=3	Left testis n=3
7.57±0.48	1.30±0.31	1.73±0.23*	7.73±0.95	1.58±0.12	2.67±0.1*

Significant: \*\*\* -  $P < 0.001$ ; \*\* -  $P < 0.01$ ; \* -  $P < 0.05$

## Conclusion

The addition of 10 mg/kg body weight Vemoherb-T (dry extract of *Tribulus terrestris*) to the forage of breeder Guinea fowls increased significantly ( $P < 0.05$ ) laying intensity, egg weight ( $P < 0.001$ ), yolk weight ( $P < 0.01$ ), shell weight ( $P < 0.001$ ) shell thickness ( $P < 0.001$ ), Hu ( $P < 0.05$ ).

No significant differences were found about glair weight and yolk color between the control and experimental groups. The tested product improved the egg fertility.

It was found the higher testes weight in experimental Guinea fowl cocks.

## Istraživanje uticaja ekstrakta *Tribulus terrestris* na neke reproduktivne osobine morki

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### Rezime

Uticaj bugarskog proizvoda Vemoherb-T (suvi ekstrakt biljke *Tribulus terrestris*) na neke reproduktivne osobine morki (*Numida meleagris*) je bio predmet istraživanja. Ogled je izveden na 30 biserno-sivih morki u uzrastu od 32 nedelje, koje su bile podeljene na dve grupe, 12 ženki i 3 mužjaka u svakoj grupi. Ptice iz obe grupe su dobijale obrok koji se sastojao od iste smeše. Eksperimentalna grupa je dobijala proizvod koji se testirao, jednom dnevno u dozi od 10 mg/kg telesne mase u trajanju od 12 nedelja. Intenzitet nosivosti, morfologija jaja i plodnost, težina testisa i jajnika su kontrolisani. Utvrđeno je da je nosivost bila veća ( $P < 0.05$ ), kao i težina jaja ( $P < 0.001$ ), težina žumanceta ( $P < 0.01$ ), težina levih testisa ( $P < 0.05$ ) i plodnost kod grla iz eksperimentalne grupe. Nije utvrđena signifikantna razlika kod vrednosti težine belanceta i boji žumanceta između dve grupe.

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