

Dried black soldier fly larvae *Hermetia illucens* in diets to growing pigs

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INTRODUCTION

The world scientific community actively discuss prospects of insects protein usage as an alternative of animal and soy protein. One of the most promising types of insects is *Hermetia illucens* (or «black soldier fly»). Analyses of nutrient value indicate that larvae of black soldier fly grown on feed grain have a rich nutritional value. The new direction is the usage of biomass insects in probiotic feed additives as a growth factor to stimulate probiotic bacteria and strengthen the physiological activity of these additives.

The aim of this study was researching the nutritive value of *Hermetia illucens* larvae raised on forage wheat, as a protein alternative to fish meal, at introducing them for young pigs' fodder at growing period, as well as the estimation of the biological activity of the complex probiotic preparation, which contains *Bacillus* type microorganisms on a phyto-carrier, combined with *Hermetia illucens* raw larvae homogenate (untreated hemolymph) in the ration of young pigs.

MATERIALS AND METHODS

The physiological research using animals was complied with all relevant federal guidelines from the Federal Service for Veterinary and Phytosanitary Surveillance and institutional policies.

The efficacy of supplement was tested on 61-87-days old F-1 generation of Large White x Landrace (LW x L) pigs (n=3) that were randomly divided into control and 2 experimental groups after weaning. The 2nd experimental group was fed with enriched fodder containing 7.0% of black soldier fly larvae (FL). The 3rd experimental group was fed with enriched fodder containing 5.0% fish meal (FM), with introduction of «ProStor» bioactive additive with the larvae (FL) at the dosage 0.5 kg/t.

The groups were fed with pig fodder designed for growing piglets based on nutrient and energy requirements. All pigs were weighed at the beginning and end of experiment, and actual feed consumption was evaluated daily. Animal survival rate was estimated in percent alive piglets by the end of experiment. After finishing the experiment average samples of feed, faeces and urine have been chemically analyzed in the lab of chemical and analytical research at the L.K. Ernst Research Institute of Animal Husbandry, in accordance with common analysis procedures.

The amino acid composition has been defined in the lab of the Scientific Centre «Feed and Metabolism» at the Stavropol State Agricultural University, on the amino acid analyzer AAA-400 (Czech Republic).

The composition of fatty acids has been determined in L.K. Ernst Research Institute of Animal Husbandry biochemical and analytical department, on the Shimadzu GC-2010 gas chromatograph (Japan).

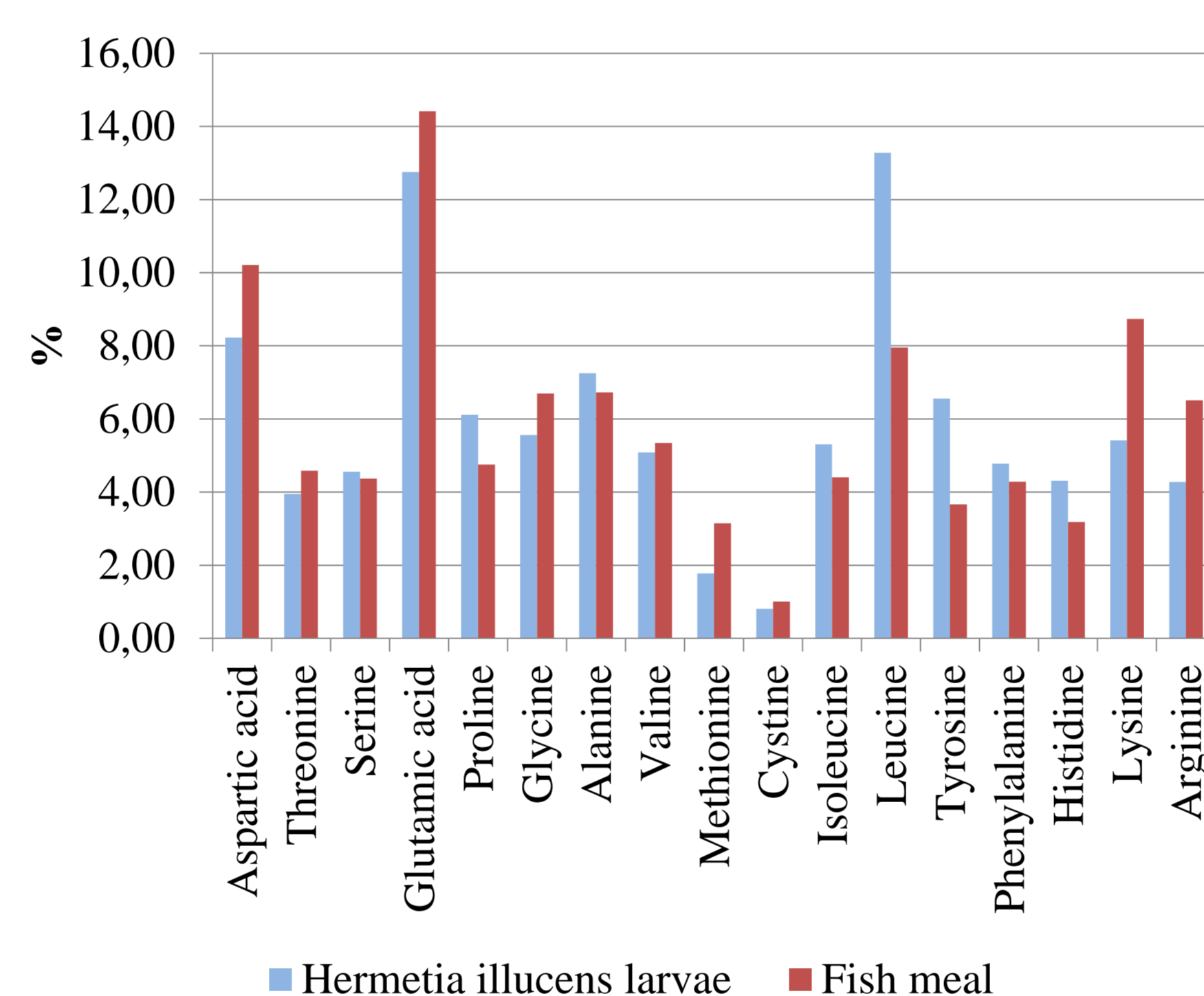
Fat separation was carried out after grinding the larvae via a method of extraction of lipids with chloroform-methanol mixture (according to Folch). Obtaining of fatty acid methyl esters.

RESULTS

Nutritive value of *Hermetia illucens* larvae obtained through their reared on forage grain, is quite high: ME (pigs) - 15.28 MJ/kg; DM - 92.55%; CP - 37.57%; CF - 38.29%; chitin - 5.19%; CA - 3.62%; Ca - 0.41%; P - 0.32%; free-nitrogen extracts - 14.08%.

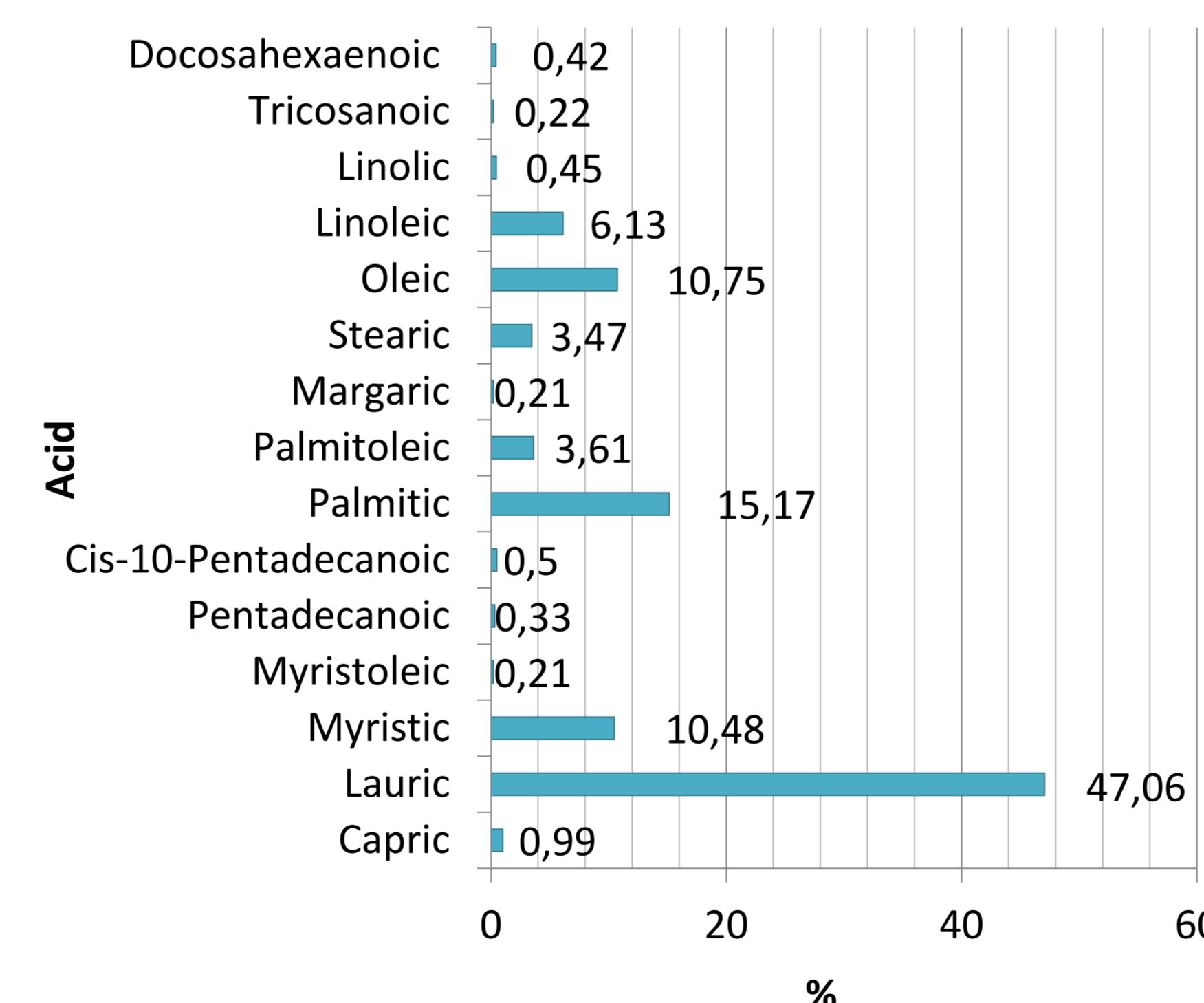
The contents of amino acids, as calculated on 100 % of crude protein, are shown in the fig. 1.

Fig. 1. Comparative contents of amino acids (calculated as 100 % of crude protein) in fish meal and in *Hermetia illucens* larvae



Fatty acid contents in *Hermetia illucens* larvae are illustrated in fig. 2.

Fig. 2. Fat acid composition of *Hermetia illucens* larvae, %



Lauric acid is featured with antimicrobial activity, what can be an important factor in prophylactics of intestinal infections and in enhancing the total animal resistance. Following unsaturated fatty acids are present too: ω-6 – linoleic, ω-9 – oleic acid. The presence of ω – 3 fatty acids results in enhancing the nutritive value of the product.

The data obtained confirm that the investigation of *Hermetia illucens* larvae as an alternative to fish meal, at their corresponding adding levels to feed, is of indisputable interest.

In the physiological experiment we have shown the possibility of a successful introduction in the diet of pigs 7% dried larvae *Hermetia illucens* as an alternative to fish meal (5%). Also we used ultrasmall doses of the homogenate of raw insect (untreated hemolymph) in the composition with complex probiotic preparation. We used 0.5 kg/ton of complex probiotic additives («new ProStor»).

The results of study showed that the usage of dried larvae *Hermetia illucens* in fodder increased average daily gain on 6.7-14.4% as compared with controls.

Table 1. Dynamics of the growth of test pigs (M±m, n=3)

Index	Group		
	1-control	2-trial	3-trial
Living weight at the trial start, kg	17.67±0.29	17.47±0.38	16.80±0.34
Living weight at the trial end, kg	30.67±6.17	31.33±2.70	31.67±0.20
Absolute growth rate of living weight, kg	13.0±0.90	13.87±0.47	14.87±0.24
Average daily growth, g	500.0±28.36	533.3±14.66	571.8±7.57
Idem, in % in real to the control	100.0	106.7	114.4

Physiological evaluation showed improvement of digestibility of fodder's nutrients including dry matter on 5,6-6.4%, crude protein on 2.6-3.0%, crude fiber on 11.8-21.5% and non-nitrogen extracted substances on 5.4-5.7% due to addition of dried larvae *Hermetia illucens*.

Table 2. Indices of digestibility of nutrients, % (M±m, n=3)

Nutrient	Group		
	1-control	2-trial	3-trial
Dry matter	74.85±1.17	80.4±1.61*	81.28±1.04
Organic substance	76.85±1.02	81.82±1.48	82.63±0.97*
Protein	79.82±1.32	82.45±1.72	82.85±0.67
Fat	53.71±1.78	64.05±6.45	55.37±1.98
Fibre	29.6±6.73	41.39±4.20	51.09±2.15*
Free-nitrogen extracts	81.35±1.06	86.79±0.91*	87.02±1.12*

P:*)- <0,05

CONCLUSIONS

Thus, we can consider the dried larvae *Hermetia illucens* as well as larva's biologically active element as a component of animal feed in feeding of growing pigs.

