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Biological studies on mulberry silkworm and the possible benefits of pupae as rich protein source in feeding fish

By

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LIST OF ABBREVIATIONS

Abbreviations	Full name
AKH	Adipokinetic hormone
ALT	Alanine aminotransferase
A. vera	*Aloe vera*
ALA	alpha linolenic acid
AVP	antiviral proteins
AST	Aspartate aminotransferase
ADG	Average daily gain
B. mori	*Bombyx mori* L.
CHO	Carbohydrate
CF	Crude fiber
CP	Crude protein
DLC	Differential leukocytic count
DO	Dissolved oxygen
DM	Dry matter
EHDSP	Enzymatic hydrolysates of defatted silkworm pupae
EE	Ether extract
EDTA	Ethylene diamine tetra-acetic acid
FCR	Feed conversion ratio
FI	Feed intake
FMM	Fermented mixture meal
FBW	Final body weight
FM	Fish meal
GE	Gross energy
GR	Growth rate
Hb	Haemoglobin
IBW	Intial body weight
LDH	lactate dehydrogenase
LJ	Lemon juice
LSO	Lettuce seed oil
MAF	Market available feed
MCH	Mean corpuscular haemoglobin
MCHC	Mean corpuscular hemoglobin concentration

Abbreviations	Full name
MCV	Mean corpuscular volume
ME	Metabolizable energy
Min.	Minute
Mo	Moisture
NFE	Nitrogen free extract
NPV	Nuclear polyhedrosis virus
O. basilicum	*Ocimum basilicum*
PCV	Packed cell volume
PUFA	Polyunsaturated fatty acid
PER	Protein efficiency ratio
PI	Protein intake
PPV	Protein productive value
RBCs	Red blood cells count
SM	Shrimp meal
SCO	Silkworm chrysalis oil
SEOF	Silkworm excrement organic fertilizer
SWEP	Silkworm excrement powder
SWF	Silkworm feces
SWM	Silkworm moth
SWPM	Silkworm powder meal
SWP	Silkworm pupae
SBM	Soybean meal
SO	Soybean oil
SGR	Specific growth rate
SR	Survival rate
SAA	Synthetic amino acids
TL	Total lipid
TP	Total protein
TWG	Total weight gain
VB	Vitamin B
VC	Vitamin C
WBCs	White blood cells count

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VI- SUMMARY

The effect of some food additives on the mulberry silkworm biological traits were studied in addition to the effect of replacing fish meal with silkworm pupae and feces on the growth and biochemical parameters of Nile Tilapia fish.

I. Effect of food additives on silkworm biological parameters.

The current investigation was carried out in Plant Protection Research Institute, Sakha branch, Egypt under the laboratory conditions of 25±2C° and hygrothermic of 65-70 % R.H. Mulberry leaves were treated with some food additives like oils, fresh juices (lemon and orange), ascorbic acid (synthetic VC) and red beet extract then, provided to silkworm (*Bombyx mori* L.) at last larval instar, to determine the biological aspects, the results showed that:

1. Both commercial and crude basil oil extractions didn't show positive effect on the most biological traits except the no. of deposited eggs (moth fecundity ratio) which was positively affected specially when larvae fed with crude basil oil at concentrations of 0.125, 0.5 and 1% which significantly higher than control by 33.2, 33.4 and 35.1% respectively.

2. Commercial peppermint oil revealed insignificant among all treatments and control in mean weights of larvae, fresh cocoon, pupae, cocoon shell, silk gland and no. of deposited eggs. While crude peppermint oil conducted significant increase only in the mean weight of silk gland and no. of deposited eggs at 1% concentration.

3. Olive oil conducted insignificant effect among all treatments and control in the mean weights of mature larvae, fresh cocoon, pupae, cocoon shell and silk gland. While the no. of deposited eggs increased significantly at 0.125 and 0.25% treatments.

4. Insignificant effect among all treatments of thyme oil and control, except in silk gland and no. of deposited eggs, the highest result recorded for 1% concentration for all parameters.

5. Mature larvae treated with citronella oil revealed insignificant effect with slight increase at 0.25 and 1% concentration. While, fresh cocoon, pupae and cocoon shell conducted significant decrease in all treatments. No. of deposited eggs were higher than control in all treatments and the only significant increase was 46.4% at 0.5% concentration.

6. Lemon juice showed significant increase in mean mature larval weight. While, fresh cocoon and pupae recorded insignificant difference among all treatments and control. Cocoon shell, silk gland weights and no. of deposited eggs conducted significant increase in all concentration. The highest results were at 2% for cocoon shell, 8% for silk gland and 4% no. of deposited eggs.

7. Orange juice showed significant increase in the mean larval weight. No significant difference appeared on both fresh cocoon and pupal weights. Significant increase in cocoon shell weight at 2 and 4% treatments .Silk gland recorded the best results at 2 and 8% and all concentrations conducted a significant increase in the no. of deposited eggs.

8. Synthetic VC showed insignificant difference among all treatments in the studied biological parameters. Treatments with 0.5% VC showed the best result for mature larvae, fresh cocoon, pupae, cocoon shell and no. of deposited eggs.

9. Feeding silkworm with boiled and cold red beet juice conducted insignificant increase in mature larval weight, while heated red beet juice presented a significant increase. Fresh cocoon showed insignificant effect on cold and boiled red beet, but heated red beet presented positive changes which significantly higher than control at low concentration of 12.5%, which improved the most biological traits of mulberry silkworm at last larval instar.

II. Effect of silkworm (bi-product) on growth and physiological parameters of Nile tilapia fish

SUMMARY

This part of study was carried out at the fish lab, Sakha, Aquaculture Research Unit, and Central Laboratory for Aquaculture Research-Abbassa. Egypt.

A group of 210 of Nile Tilapia fingerlings with 22gm average initial weight were randomly distributed in 21 glass aquaria, each one has contain 10 fishes for 11 weeks to study the effect of silkworm bi-product (pupae and feces) on growth performance , haematological and biochemical studies of Nile tilapia *(Oreochromis niloticus*) fingerlings.

The results showed that:

1- Nile tilapia fish fed on diets containing silkworm pupae (SWP) showed significant increase on final body weight, total weight gain, average daily gain and specific growth rate in all treatments. On the other hand, fish fed on silkworm; feces (SWF) revealed insignificant decrease. Survival rate was insignificant among all treatments and control.

2- Significant increase in feed intake (FI), protein efficiency ratio (PER) protein productive value (PPV) and significant decrease in feed conversion ratio (FCR) at 40%SWP.

3- Significant increase in crude protein (CP) and ash content at 40% SWP but significant decreases in ether extract (EE).

4- Significant increase in RBCs count in all treatments except 50% SWF was not significant with control.

5- Increasing of Hb content and PCV in all treatments than control.

6- Insignificant difference in MCV result between all treatments and control except 30 and 50% SWP that were significantly lower.

7- Insignificant difference in MCH in SWP and SWF treatments except 30% diets which were lower.

8- MCHC results conducted insignificant among all treatments and control.

9- Insignificant difference in serum AST, ALT urea and creatinine in all treatments.

10- Insignificant difference with control in total protein, albumin and globulin results except in 40% SWP which increased significantly. Glucose, uric acid, cholesterol and triglyceride didn't appeared negative effect on the fish.

11- Phagocytosis effect showed insignificant effect on all fish groups.

Conclusion

It could be concluded that treatments with oils fortified to mulberry leaves significantly increased the no. of deposited eggs (moth fecundity). It is found that thyme oil at 1% gave the best biological parameters followed by peppermint at 0.5 and 1%.

Fortification of both lemon and orange juice showed improvement in the measured biological parameters of SWP. Synthetic VC showed the best biological parameters at 0.5%. Also, treatment with heated red beet showed significant increase at 12.5%

Fish meal can be substituted with silkworm pupae up to 40% concentration in Nile tilapia fish showing positive effect on growth performance and without changes in haematological and biochemical parameters.

Recommendation

Attention on using of different food additives for improvement of mulberry leaves and studying their effect on silkworm biological parameters.

Using of silkworm pupae as unconventional cheep and high protein source of protein in fish diets outside the laboratory domain**.**

More research in this regard because of its economic impact and support for the practical side.