A step towards a circular aquaculture: integration of duckweed (*Lemna* ssp.) into as sustainable protein source

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XV. International Aquaculture Conference
2025.04.04.

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Introduction I.

- Aquaculture is the fastest growing food production sector → demand for fish meal
- Insects as potential protein source for aquaculture
- Black soldier fly (*Hermetia Illucens*)
  - Fast growth
  - Good amino acid composition
  - Recovery of organic materials

Introduction II.

- Application of waste and by-products through protein production

- Duckweed (*Lemna* ssp.)
  - Valuable biomass
  - Unwanted in pond aquaculture
  - Produced in large quantities

Source:. https://www.tiszatoelovilaga.hu

Objectives


Photo: István Bartos

Integration of duckweed into black soldier fly production

Use of the resulting product in fish feed for african catfish fry rearing


Photo: László Kathi

Materials and methods I.

Experimental design

- Controlled environmental parameters
  - Temperature: 28±2℃
  - Humidity: 70±10%
- 5 replicates/treatment
- 20.000 pcs 5 days old larvae/ rearing unit
- Rearing duration: 5 days

Materials and methods II.

Drying of the duckweed

- Up to 94% moisture content
- Dried until 21% moisture content
- 72 hours
- Vacuum packing and freezing on -20 ℃ until the use

Materials and methods III.

Rearing substrates

Experimental substrate (DW)

- 85% duckweed + 15% feed corn
- Components grinded
- ~70% moisture content

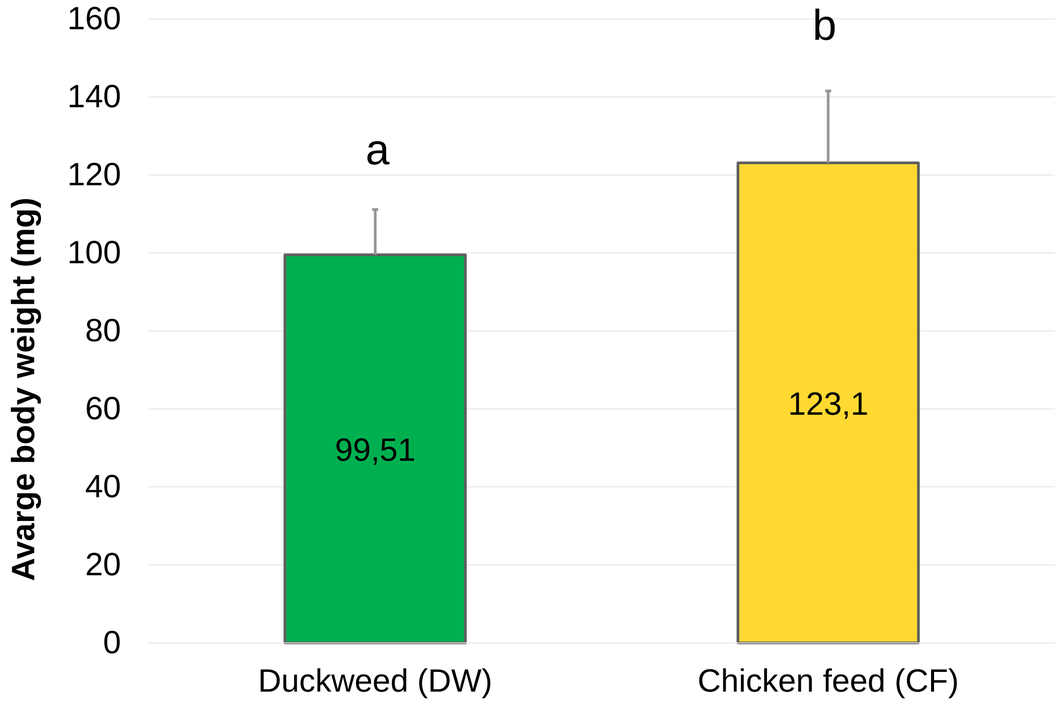
Control substrate (CF)

- 40% Vitafort chicken feed + 60% water
- Grinding was not necessary
- ~65% moisture content

- Substrates were equalized for dry material

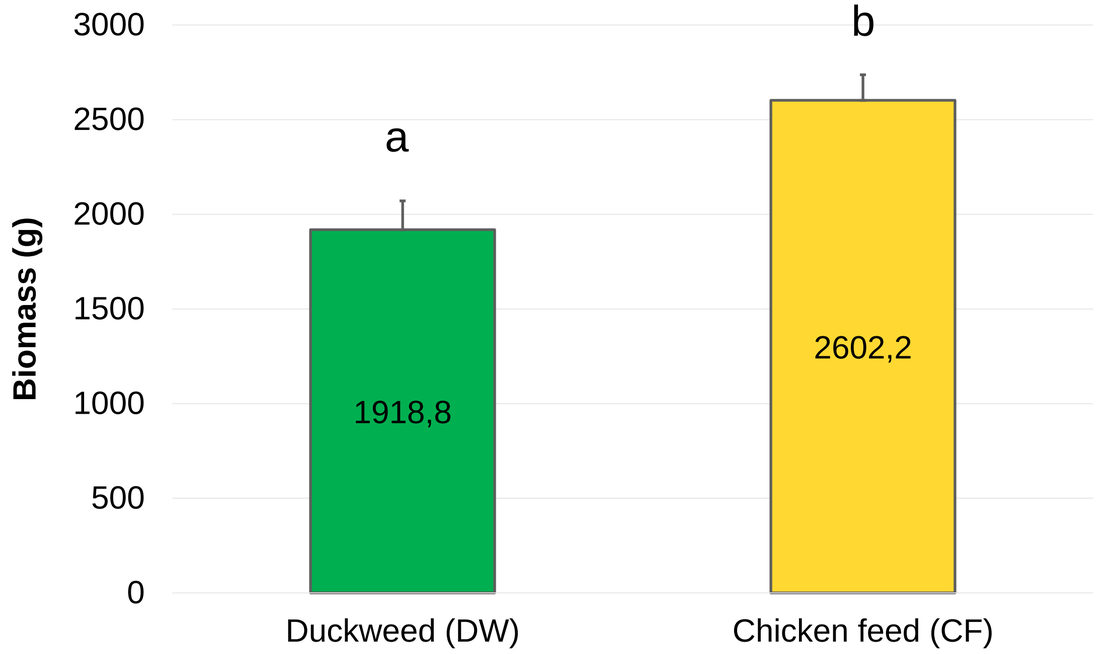
Results I.

Avarage body weight of black soldier fly larvae in different treatment groups



N=100/kezelés P=0,0031

Avarage biomass/rearing unit of black soldier fly larvae in different treatment groups



N=5/kezelés P<0,0001

Results II.

	BSF Larvae DW	BSF Larvae CF
SFA	43,3	54,8
MUFA	10,7	10,8
PUFA	46,0	34,4
PUFA n-6	45,6	33,8
PUFA n-3	0,3	0,6

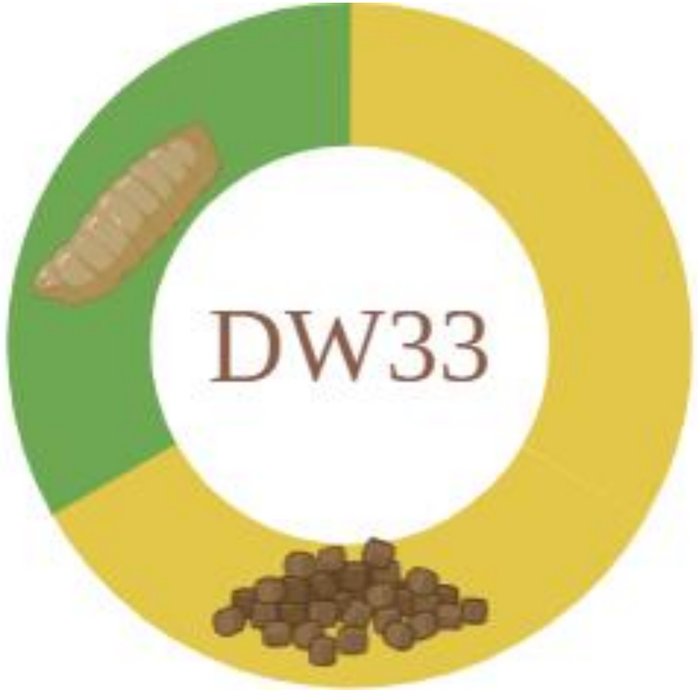
	BSF Meal DW	BSF Meal CF
Moisture content (g/100g DM)	4,2	4,3
Crude protein (g/100g DM)	52	52,7
Fat (g/100g DM)	9,3	11,6

Materials and methods IV.

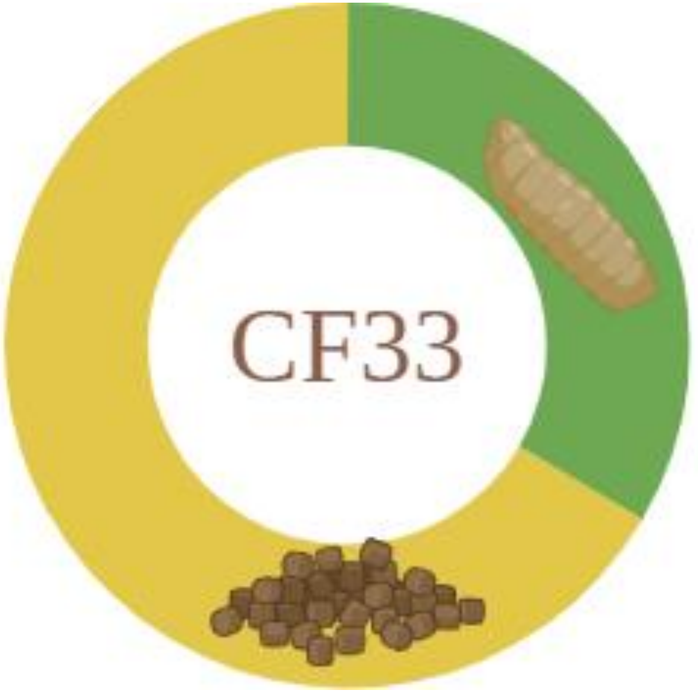
Experimental feeds

Control (C)
Aller Infa Fry feed
Crude protein: 64%

DW33
33% of feed was replaced with black soldier fly meal made on DW substrate
Crude protein: 56%



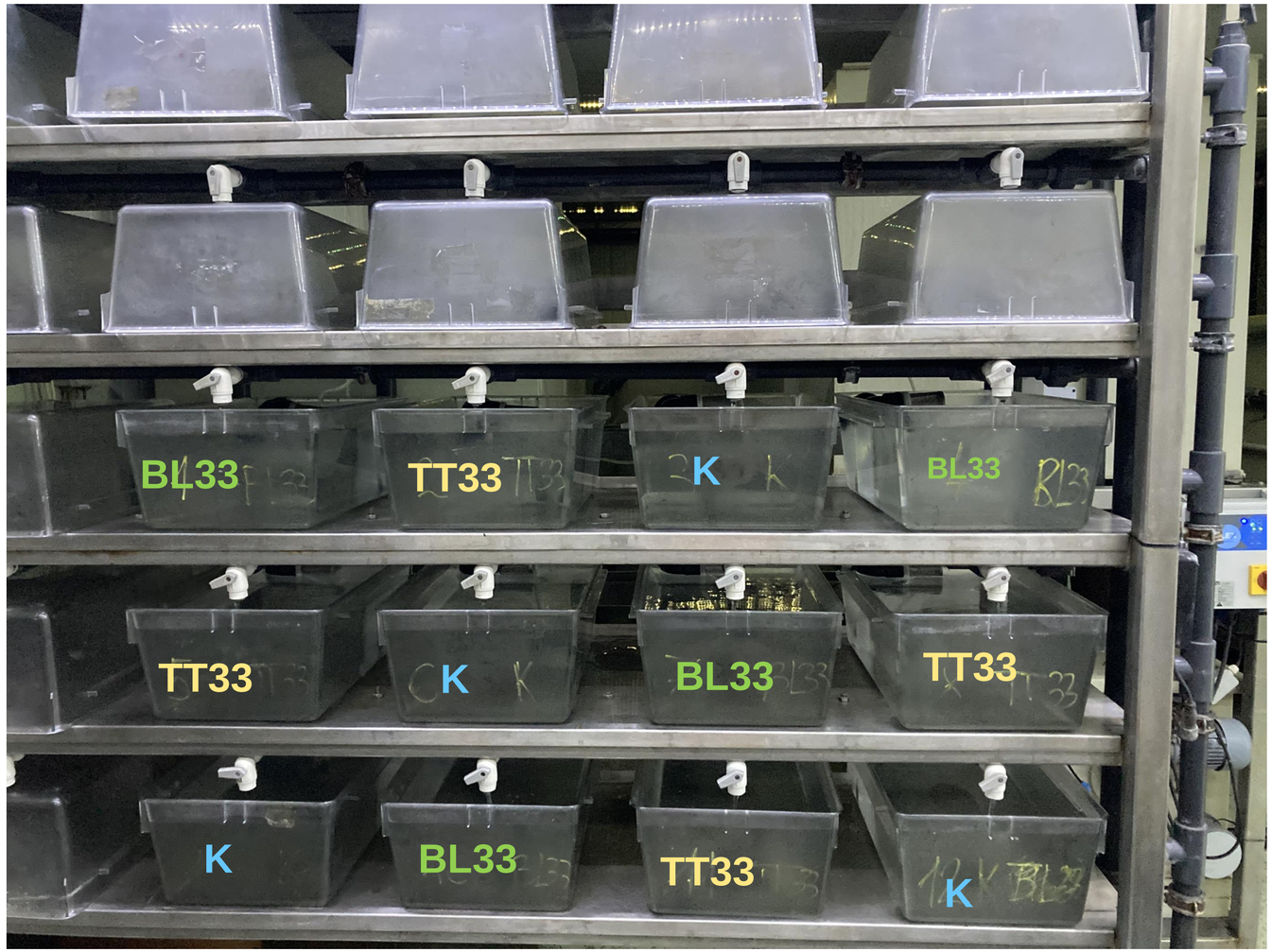
CF33
33% of feed was replaced with black soldier fly meal made on CF substrate
Crude protein: 56%



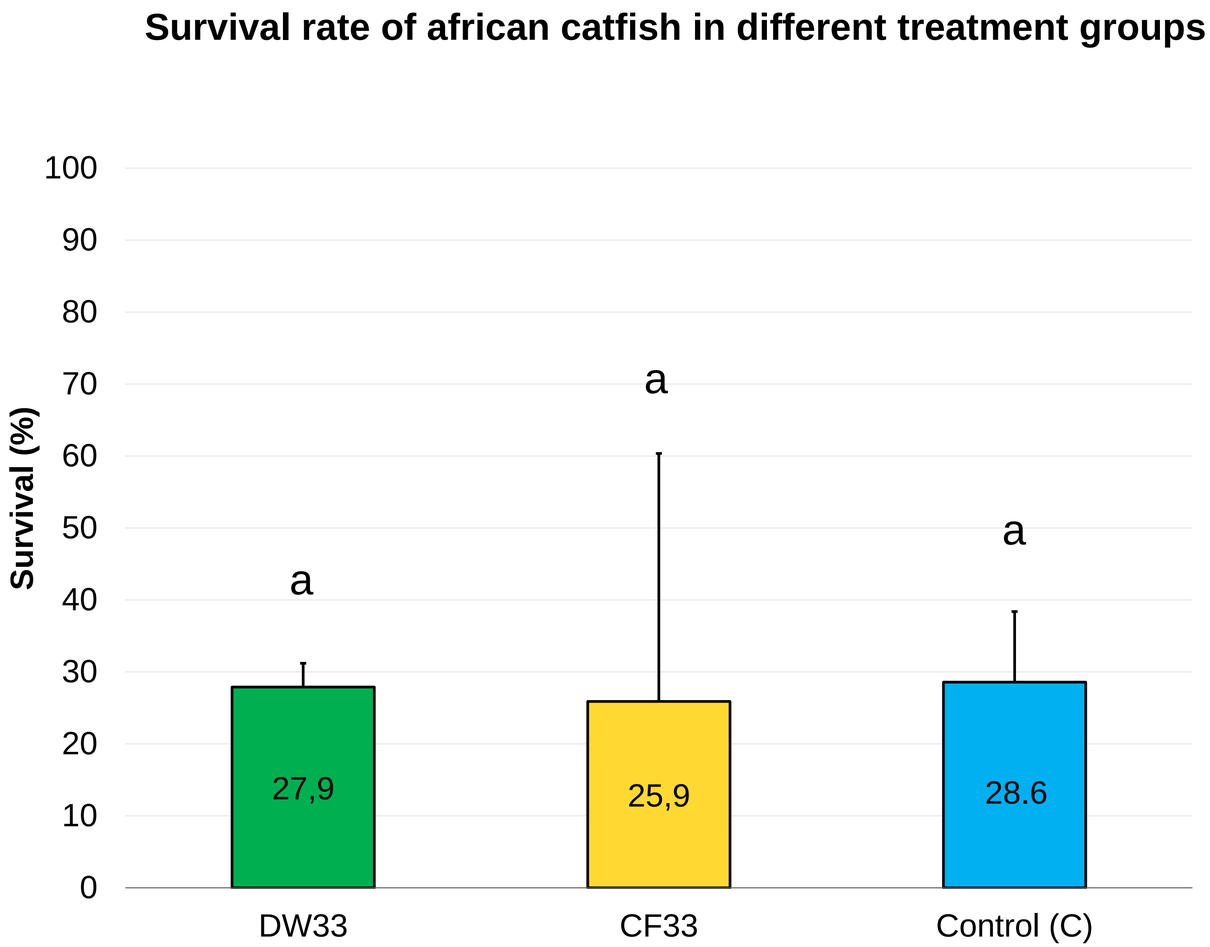
Materials and methods V.

African catfish fry rearing

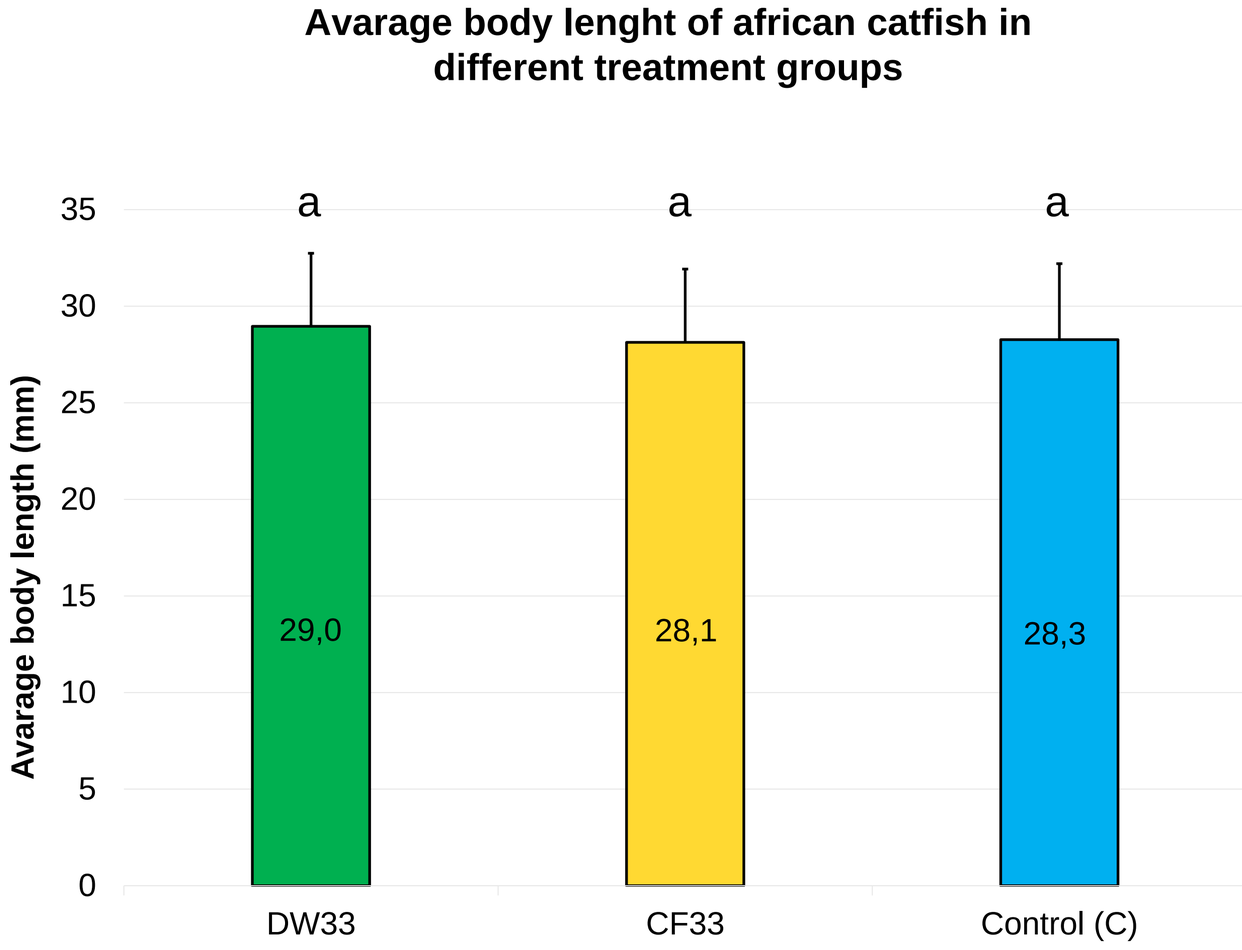
- 300 African catfish (*Clarias gariepinus*) fry/tank
- 12 pcs 10 litre tank
- 3 treatments
  - Control
  - DW 33%
  - CF 33%
- Feeding: 3 times/day
- Experiment duration: 28 days



Results III.

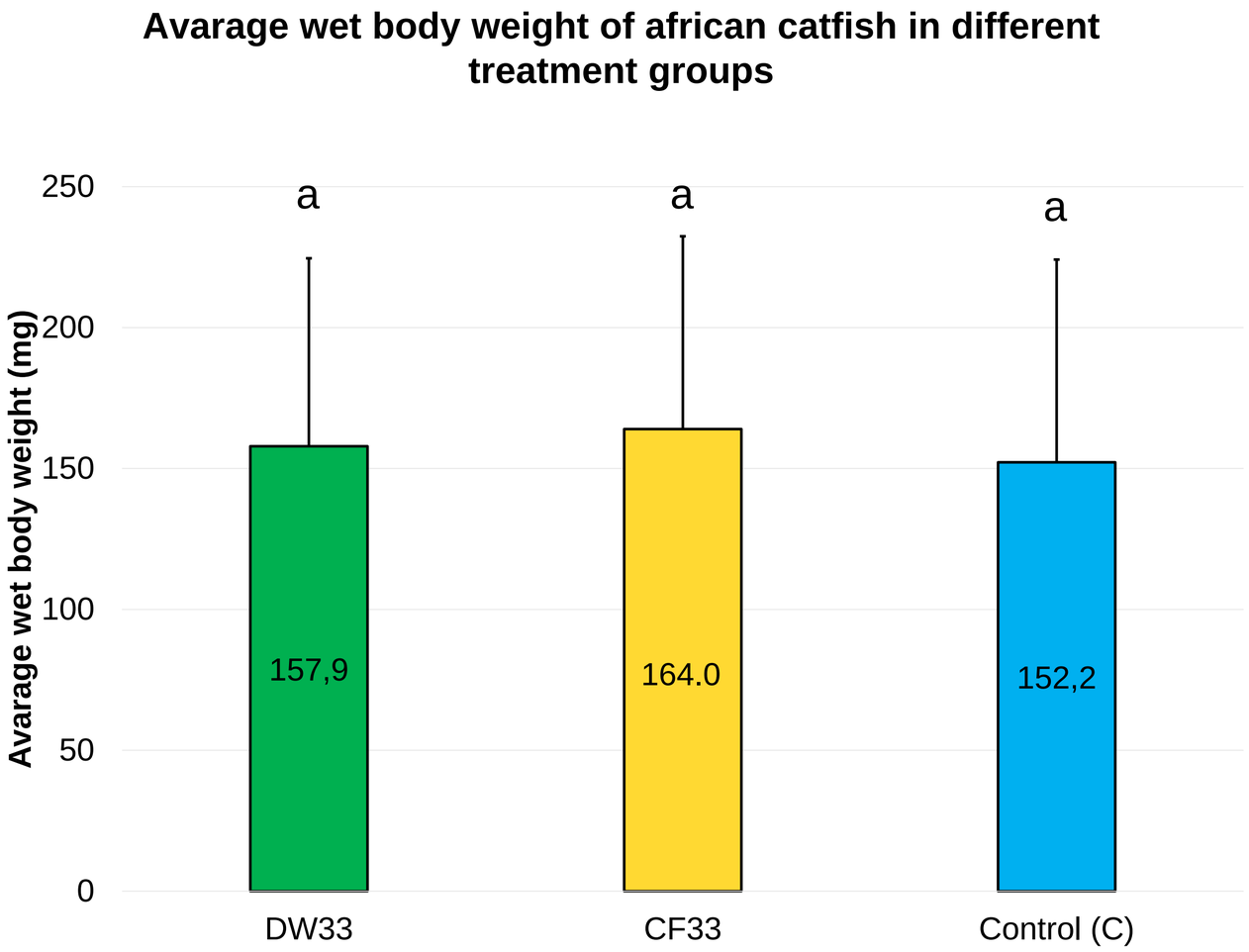


N=4/kezelés P=0,3941

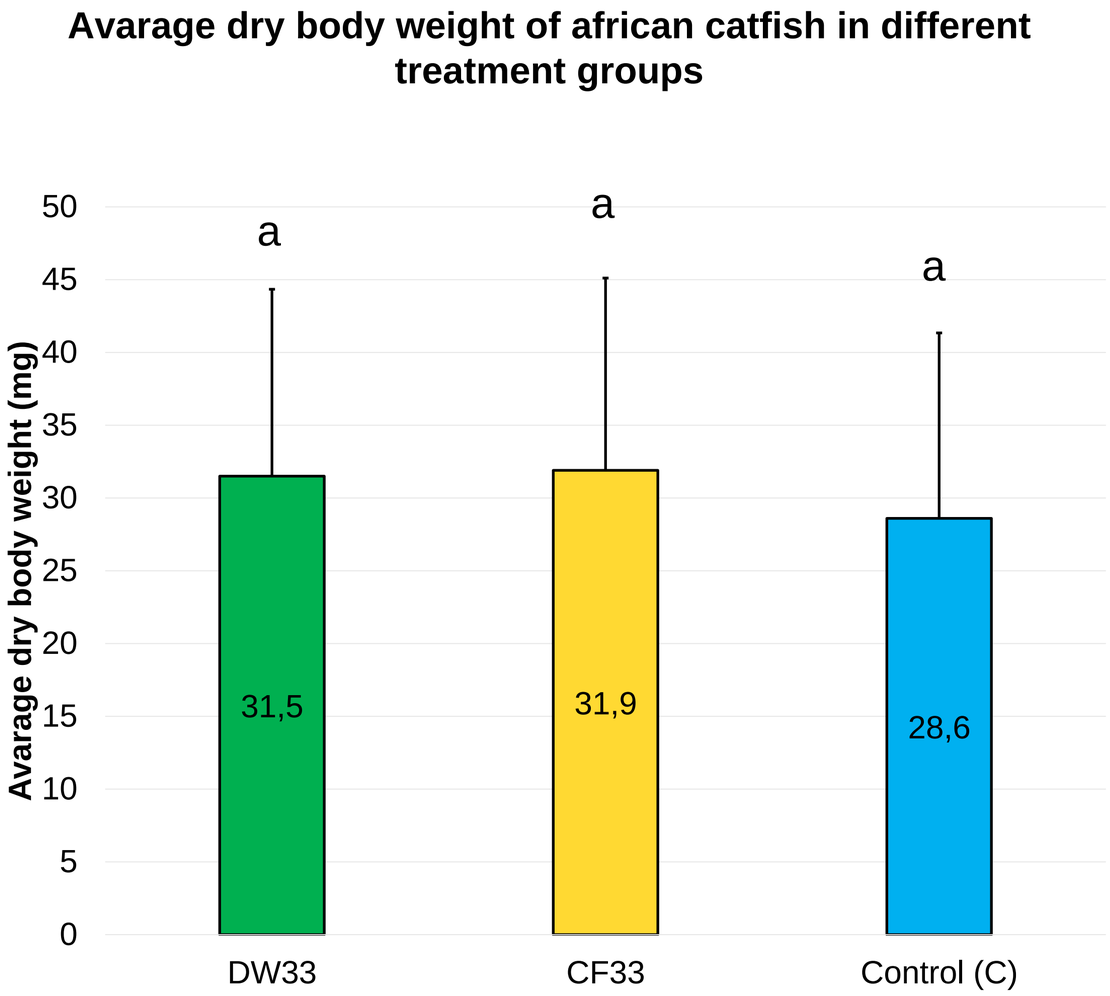


N=80/kezelés P=0,3423

Results IV.



N=80/kezelés P=0,558

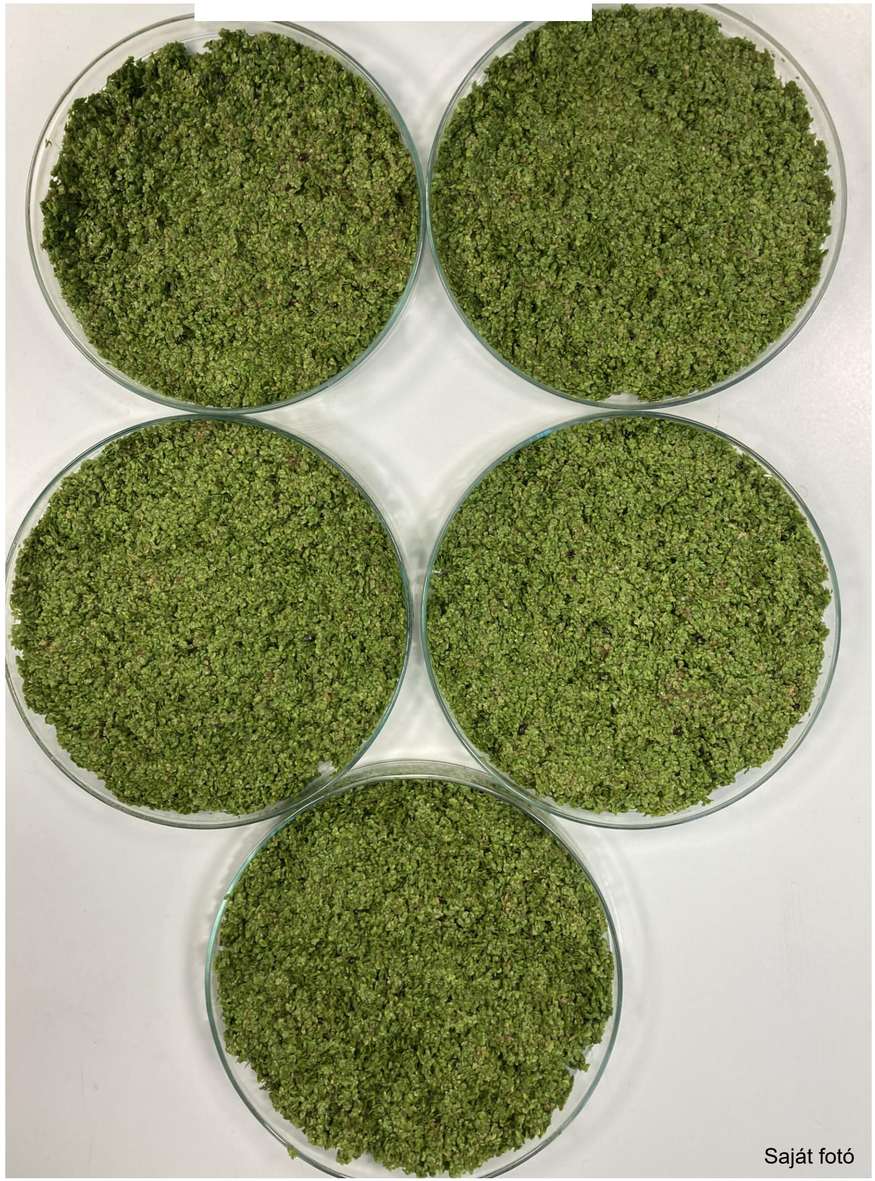


N=80/kezelés P=0,1927

Discussion

- The duckweed is suitable for rearing black soldier fly larvae, and favourable nutration content values were obtained for larvae reared on duckweed substrate

- The larvae made on duckweed substrate after processing to defatted meal can replace 33% of the fry feed without negatively affecting the main economic indicators, i.e. survival, body length and body weight



Saját fotó

Acknowledgement

Balázs Csorbai PhD
István Szabó PhD
Gergely Bernáth PhD
Ákos Horváth DSc
Dávid Várkonyi
László Kathi
Agroloop Hungary Kft.
&
everyone who helped me
with my work

Supported by the EKÖP-MATE/2024/25/D university research scholarship Programme of the Ministry for Culture and Innovation from the source of the National Research, Development and Innovation Fund

This work was supported by the Research Excellence Programme and the Flagship Research Groups Programme of the Hungarian University of Agriculture and Life Sciences.

Hvala na pozornosti!

Tamás Bartucz

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