DEFATTED MEALWORM (*TENEBRIO MOLITOR*) LARVAE MEAL AS A SUSTAINABLE FEED SOURCE FOR EUROPEAN SEA BASS


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SUMMARY

This research investigated the effect of fish meal replacement by defatted mealworm (*Tenebrio molitor*) larvae meal in European sea bass (*Dicentrarchus labrax*) aquafeeds and showed that it is possible to replace up to 80% of fish meal by insect meal without impairing growth performance, digestibility and flesh quality. These results will be of particular interest to sea bass farmers who wish to use insect-based meals as an alternative food source for their stock.

KNOWLEDGE NEED

The European sea bass (*Dicentrarchus labrax*) is one of the most important fish species in European and Mediterranean aquaculture. A major challenge to efficient production of European sea bass and other species is the high cost of aquafeeds. Additionally, the supply of key nutrients found in fish meal and fish oil is limited. However, completely replacing these ingredients with a different feed source in the fish's diet can lead to adverse effects, for example decreased digestion efficiency and increased susceptibility to diseases and stress. Alternative fish feed sources with high biological value and low competitiveness with human food are needed, and their optimum substitution levels must be established.


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POTENTIAL IMPACT

- Substituting European sea bass diets with insect meal reduces the need for fish meal and oil, which are costly, volatile and unsustainable sources. This could lead to a more sustainable aquaculture sector.
- The establishment of the optimum level of fish meal substitution with insect meal for sea bass opens the door for further research into its applicability for other aquaculture species.
- The findings contribute towards improving ecological and social sustainability of fish feeds, especially if applied to multiple species.

EATiP - Strategic Research and Innovation Agenda (SRIA) Thematic Area 4 – Sustainable Feed Production; Goal 1 and Goal 2. To see the full list and descriptions of the thematic areas and goals, please visit: **eatip.eu/?page_id=46**

UNDERLYING SCIENCE

A feeding experiment was carried out to evaluate the effect of four different experimental diets with increasing replacement levels of fish meal by defatted *Tenebrio molitor* larvae meal: 0% (control diet), 40 (TM40), 80 (TM80) and 100% (TM100) of replacement. The effect of these dietary treatments were assessed through the analysis of growth performance, digestibility, nutrient utilisation, intestinal morphology, muscle total lipid content and fatty acid profile, muscle instrumental texture and colour, plasma metabolites and humoral immune parameters and expression of genes related to growth and lipid metabolism.

RESULTS

- The voluntary feed intake decreased in fish fed TM100, but these fish had the best FCR resulting in similar final body weight among treatments.
- Up to 80% replacement did not impair protein digestibility and the morphologic integrity of the intestine was maintained.
- Whole body lipid content and the hepatosomatic index increased in fish fed TM100, but flesh total lipid content, colour and texture remained similar among dietary treatments.
- Total replacement of fish meal did not alter the ACH50 and lysozyme activity but increased plasma peroxidase activity.
- The eicosapentaenoic (EPA) and docosahexaenoic (DHA) acids remained unaffected in fish fed diets up to 80% replacement level.
- The hepatic expression of lipogenic enzymes (*elovl6, scd1b, fads2*) and key enzymes of bile acid biosynthesis (*cyp7α1*) was consistently down-regulated by defatted TM.
- Changes in the expression profile of myogenic factors evidence different compensatory mechanisms to preserve high muscle protein accretion with the inclusion of TM.

END-USERS & POTENTIAL APPLICATIONS

END-USER 1: European sea bass fish feed producers
APPLICATION: Developing and producing novel feed formulations for European sea bass (and potentially other species) based on alternative, safe and sustainable feed sources (insect meal) with high biological value and low competitiveness with human nutrition.

END-USER 2: European sea bass fish farmers
APPLICATION: Feeding of aquaculture fish stocks with more sustainable (and potentially cheaper) fish feeds while keeping good production levels, leading to higher profits and reduced environmental impact.

END-USER 3: Aquaculture marketing and lobby groups
APPLICATION: Supporting a sustainable, dynamic image of the aquaculture sector, working towards improving global food security while decreasing environmental impact.

END-USER 4: Aquaculture research community
APPLICATION: Furthering knowledge relating to fish meal replacement and its effect on many aspects (such as growth, digestibility, flesh quality, etc.), in European sea bass and other species. This will support development of the aquaculture sector and contribute to increased levels of Technology Readiness, and progression towards commercialisation.

STATUS

Technology Readiness Level (TRL) 4 – the knowledge has been validated in a laboratory environment.

Further research is needed to:

- Investigate further effects of the *Tenebrio* diet substitution on immune status, microbiota composition and acceptability by consumers.
- Explore suitability for other species.
- Perform feeding trials on a commercial scale (i.e. validated and demonstrated in an industrially relevant environment).

AT A GLANCE

TITLE: Defatted mealworm (*Tenebrio molitor*) larvae meal as a sustainable feed source for European sea bass

KNOWLEDGE TYPE: Peer-reviewed scientific publication

WHERE TO FIND IT: Not currently publicly available

STATUS: Expected to publish in 2020

TNA FACILITY USED: Institute of Aquaculture Torre de la Sal (IATS-EXP, CSIC), Castellón, Spain

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