PHYTOGENIC-BASED FEED ENHANCES ALL-MALE MARINE TILAPIA PRODUCTION

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Introduction

- The production of all-male tilapia populations is widely favoured in aquaculture as males demonstrate superior growth performance and reach market size more efficiently.
- The conventional use of the androgen 17 α-methyltestosterone (MT) for sex reversal may present potential health and environmental risks, highlighting the need for safer alternatives.
- This study evaluated phytogenic-coated commercial feed (CF), incorporating extracts of papaya seed meal (PSM) and moringa leaf powder (MLP) as sustainable and environmentally friendly masculinizing agents during the early larval development of marine tilapia.

Methods



(a) Local marine tilapia strain (*Oreochromis* sp.) used in this study and bred in captivity.
(b) Yolk-sac larvae maintained in a marine environment.
(c) Swim-up larvae utilised for aquaculture trials.
(d) Extracts of PSM (left) and MLP (right) as natural alternative masculinizing agents for feeding the swim-up larvae over a 30-day period.
(e) Fish subsequently reared for an additional two months prior to sex ratio determination.

Table 1: Experimental design

S/N	Trial	Treatment
1	Feed trial 1	PSM, MLP, MT, CF x (Ambient Temperature, AT)
2	Feed trial 2	75% PSM+25% MLP, 50% PSM+50% MLP, 25% PSM+75% MPL, CF x (AT)
3	Feed-Thermal trial	75% PSM+25% MLP x (31°C & 33°C), MT x (AT)

Results and Discussion

Feed trial 1

- MLP-coated feed registered the highest male percentage, outperforming PSM-coated feed, CF, and MT-coated feed (Fig. 1), indicating that MLP may be a viable non-hormonal substitute for MT.

Feed trial 2

- A combination of 75% PSM and 25% MLP yielded the highest male proportion, demonstrating a synergistic effect between the two phytogenic extracts in a suitable ratio (Fig. 2).
- Collectively, PSM and MLP-based diets show strong potential as alternatives to MT for promoting the development of all-male tilapia populations.

Feed-Thermal trial

- Fish reared at 31°C and fed 75% PSM and 25% MLP-coated feed had a comparable male proportion compared to those fed MT-coated feed ($P>0.05$) (Fig. 3), indicating the effectiveness of the combined strategy.

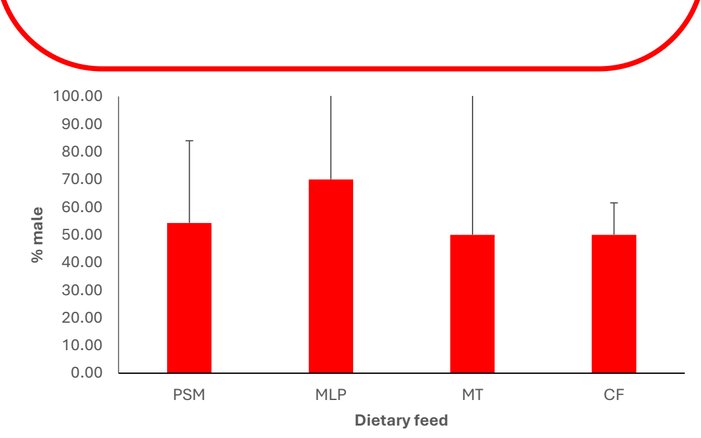


Fig. 1: Percent male population across experimental diets

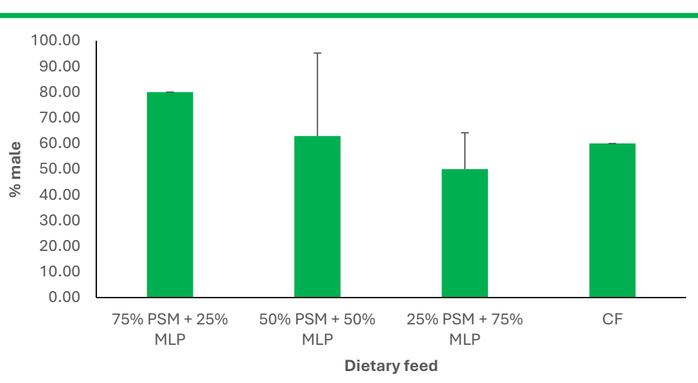


Fig. 2: Percent male population across three PSM-MLP combination ratios and commercial feed (CF)

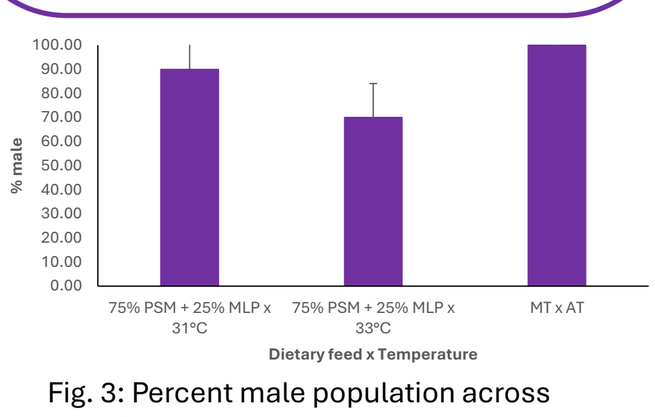


Fig. 3: Percent male population across combined feed and temperature treatments

- In trials involving both phytogenic- and MT-coated diets, fish fed phytogenic-coated diets consistently exhibited superior growth performance and greater survival than those fed MT-coated diets, highlighting the broader health benefits associated with phytogenic-based diets.
- Under these conditions, the specific growth rate (SGR) of phytogenic-fed fish ranged from 15.1% to 120.3% day^{-1} (n=8), whereas MT-fed fish showed lower SGR values ranging from 12.8% to 43.4% day^{-1} (n=2).
- Similarly, survival rates were generally higher in phytogenic-fed fish (54.0-98.0%; n=8) compared with MT-fed fish (28.0-91.0%; n=2).
- To further elucidate the mechanisms underlying these enhanced performances, gut and mucosal microbiome analysis of fish fed phytogenic-based diets compared to those fed MT-based diets is now underway.

Conclusion

- ✓ Beyond achieving effective masculinization, this synergetic approach improves survival, growth performance, and overall fish health. Its adoption can enhance productivity, reduce input costs, and support more sustainable, consumer-friendly practices in the tilapia industry, as well as with strong potential for application in other fish species.

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