Addressing dark pigmentation in shrimp post larvae

Dark pigmentation is associated with better nutrient absorption and utilisation, improved growth rate, and increased resistance to disease

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Post larvae (PL12) fed with a single meal of pigmented feed.

Dark pigmentation is a desirable trait to increase market value of shrimp post larvae. Farmers prefer dark hepatopancreas and gut because they can observe the shrimp size and activity more clearly. Dark pigmentation is associated with better nutrient absorption and utilisation, improved growth rate, and increased resistance to disease. Some hatchery operators and farmers, however, believe that the opposite is true: growth and survival of shrimp post larvae are negatively affected when their hepatopancreas and gut are pigmented.

In this article, we present results on a trial to answer some of the prevailing questions related to dark pigmentation.

Ways to achieve dark gut and hepatopancreas

The trial was conducted at the Growel Shrimp Hatchery Feed Trial Center (GSHFTC) to evaluate the effect of Growel's feed variant, Origin® 300D, on the post-larval rearing of white leg shrimp *Litopenaeus vannamei*.

The aim of this study was to determine ways to achieve dark gut and hepatopancreas colouration by offering this pigmented feed as a single feed and in combination with other feeds. The following five treatments, each with five replicates, were tested as shown in Table 1.

Essentially, post larvae were fed a cocktail diet of non-pigmented feeds, Growel Origin, and another hatchery diet from PL4 to PL7. Subsequently, feeds were changed to the dark pigmented Origin 300D either by itself for the rest of the cycle as a single feed or in a cocktail for the entire duration or just for two days.

Specific pathogen free (SPF) post larvae of the "Growth" genetic line of *L. vannamei* were obtained from in-house commercial larval rearing tanks (LRT). The shrimp post larvae (PL3) were stocked at a density of 60 PL/L in 25 tanks (approximately 8,400 post larvae per 140L tank) and reared over 10 days using a protocol widely practised in commercial hatcheries in India.

Post larvae were fed six to eight times a day. Before PL7, four meals of live *Artemia* nauplii and six meals of commercial dry feeds were given. After PL7, the dry feed meals were increased to eight meals and *Artemia* was decreased to two meals. Once post larvae reached PL 9, *Artemia* feeding was stopped completely and the feeding protocol was followed as per the experimental design.

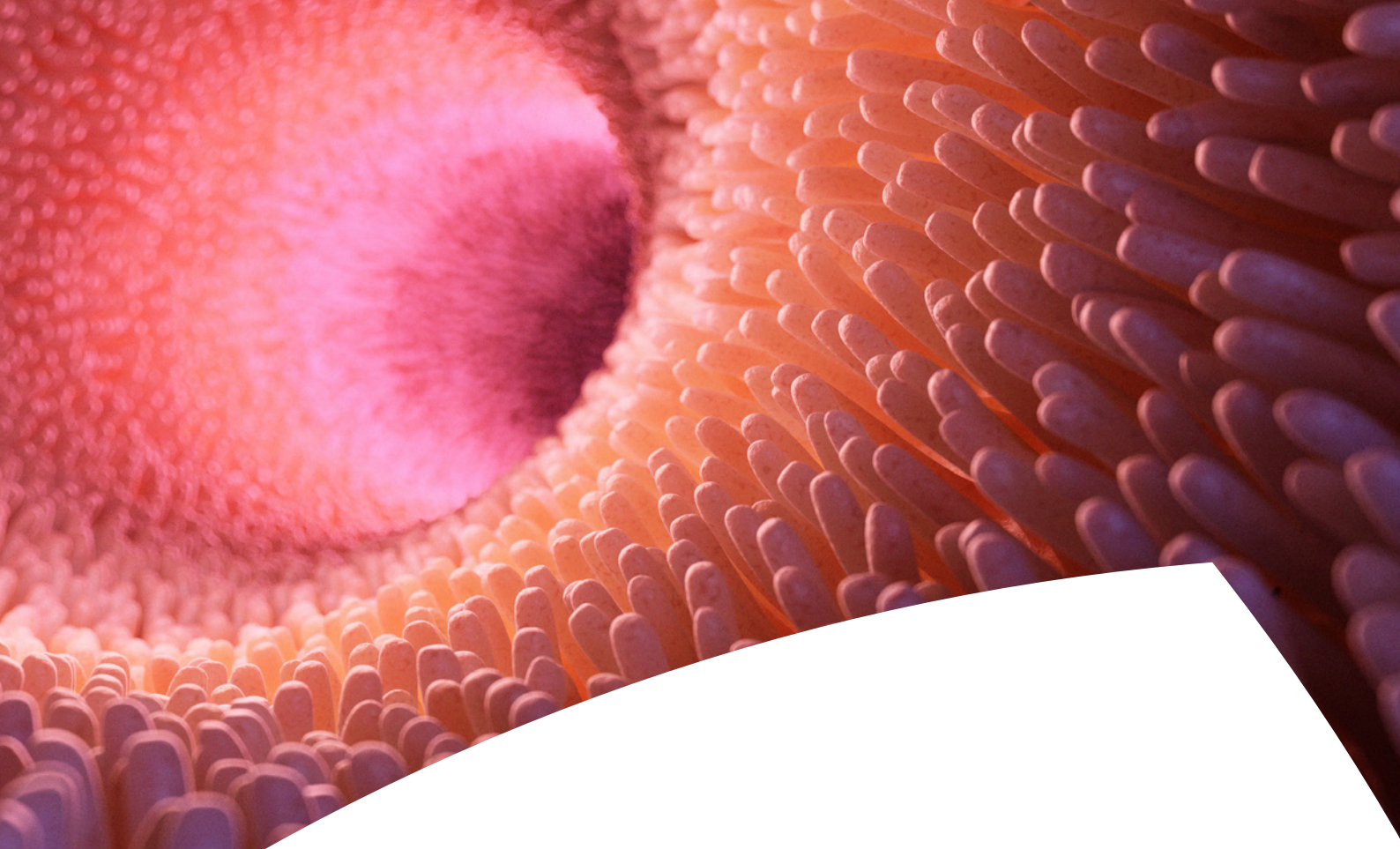
Growth and survival of post larvae

Water quality parameters such as salinity, pH and alkalinity in all treatments remained unchanged from the beginning to the end of the trial. Total ammonia nitrogen (TAN) was below 3ppm in all treatments throughout the trial. However, the TAN of water in the tanks receiving Origin 300D was lower when compared to other dietary treatments.

Post larvae performance was statistically similar across the treatments (Table 2); however, results showed a generally higher average survival for post larvae fed the pigmented feed variant.

Treatments	Description of feeds	Diet	Size range
T1	Non-pigmented control	Origin	PL8-PL12
T2	Pigmented	Origin 300D	PL8-PL12
T3	Pigmented: Non pigmented	Origin 300D: Origin (50:50)	PL8-PL12
T4	Pigmented: Non pigmented	Origin 300D: Origin (50:50)	PL8-PL10
	Pigmented	Origin 300D only	PL11 to PL12
T5	Non-pigmented	Origin only	PL8 to PL10
	Pigmented: Non pigmented	Origin: Origin 300D (50:50)	PL11 to PL12

Table 1. Treatment diets comprised various combination of non-pigmented feeds, Growel Origin and its pigmented version, Origin 300D to post larvae.



reduce this inflammation and support microbiota

increase gut microvilli length and height, improving protein and fiber digestibility

optimise growth and immune capabilities for overall better health

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Treatments	Survival (%)	Final PL Length (mm)	Final Biomass (g)	Final PL weight (mg)
T1: Origin Only (PL8-PL12)	80.91	10.62	30.97	5.6
T2: Origin 300D only (PL8-PL12)	83.25	10.79	31.63	5.8
T3: Origin & Origin300D in 50:50 ratio (PL8-PL12)	83.02	10.84	31.51	5.6
T4: Origin 300 only (PL8-PL10) followed by Origin 300D only (PL11-12)	83.74	10.95	34.99	5.8
T5: Origin 300 only (PL8-PL10) followed by Origin & Origin 300D in 50:50 ratio (PL11-12)	84.03	10.62	32.07	5.6

Table 2. Performance of shrimp post larvae fed diets with and without dark pigmentation.

The data revealed that Origin 300D does not negatively affect post larvae performance and may actually improve it slightly.

Observations on pigmentation

Phase 1 (PL3- PL7):

The shrimp post larvae's key stage is the early post larval stage. During this stage, post larvae consume both live and formulated feeds. Additionally, the consumption rate of formulated feed is relatively low. As a result, the post larvae's gut and hepatopancreas pigmentation appeared pale in colour, which was consistent across the treatments.

Figure 1. Combination of live and formulated feeds during PL4-7 resulted in pale colour of the hepatopancreas and gut.

Phase 2 (PL8-PL10)

During this phase, the diets were switched to the dark feed variant, either singly or as a cocktail feed along with the unpigmented variant Origin 300. The pigmentation results revealed that post larvae fed the dark feed variant (T2) acquired the darkest gut and hepatopancreas, followed by those fed the cocktail feed in T3. The gut colouration was the lowest in treatments 1, 4 and 5 which continued to be fed with Origin only. So, the desired gut colouration was obtained when the post larvae were fed the dark feed variant alone for two days. Combining it with the unpigmented feed for two days resulted in a moderately dark colour of the hepatopancreas.

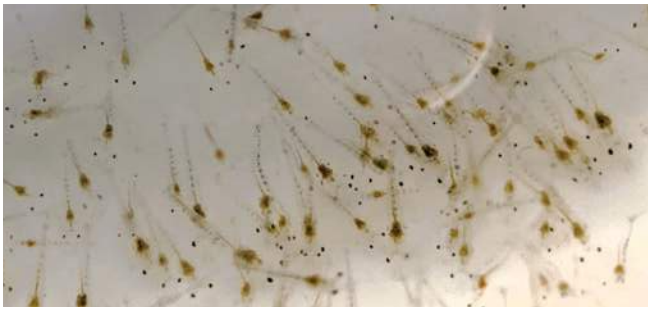

Figure 2. Post larvae fed cocktail feed showed moderate gut and hepatopancreas colour.

Phase 3 (PL11-PL12):

During the final stage of post larvae rearing, dark colouration of the gut and hepatopancreas appeared in post larvae fed Origin 300D alone, followed by cocktail meal in those that were not previously given the dark pigmentation feed. However, the darkest pigmentation was seen in T2 and T4, which were offered the dark feed from PL8 onwards.

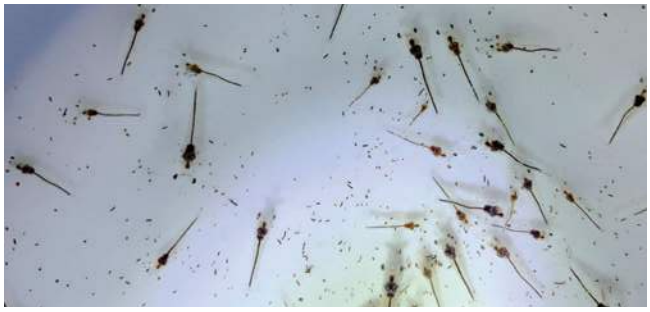

Figure 3. Dark pigmentation of shrimp post larvae during the final harvest which meets farmer preference.

Summary

Feeding with the dark pigmented Origin 300D feed did not negatively impact post larvae performance, regardless of the length of the feeding. Higher growth and survival of the post larvae fed the dark pigmented feed may indicate better nutrient absorption and utilisation, improved growth rate, and increased resistance to stress and pathogens. The trial results show that the dark pigmented feed should be applied either partially or fully throughout the late post larvae rearing to get the best results in terms of pigmentation. If the hatcheries are unable to provide the dark pigmented feed throughout the late post larvae rearing stages, they should provide it at least in the last two days prior to harvest. Exclusive administration of the dark pigmented feeds in the last 3-4 meals is highly recommended.

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