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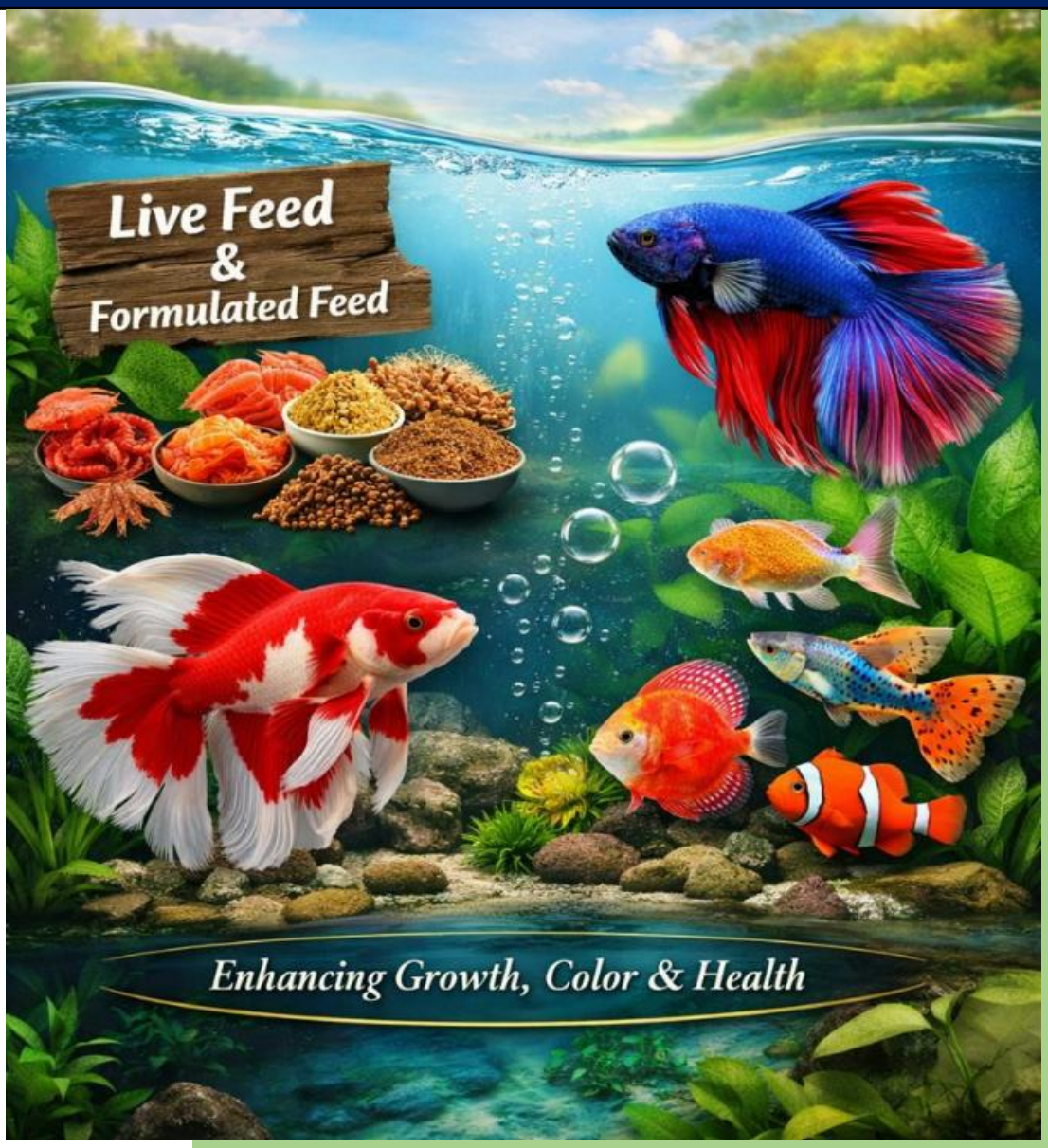
Live and Formulated Feed Management for Ornamental Fishes



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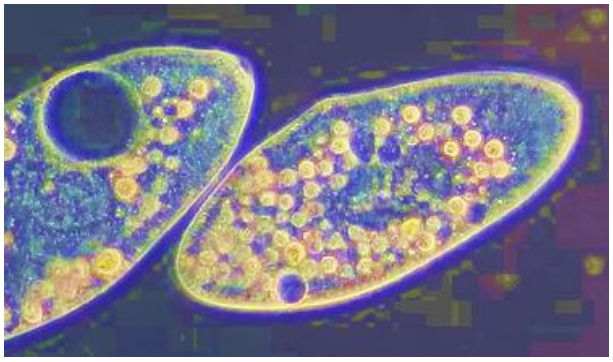
LIVE FEED FOR ORNAMENTAL FISHES

1. Infusoria

- **Scientific name:** Mixed protozoans (*Paramecium* spp., *Euglena* spp.)
- **Habitat:** Freshwater ponds, decaying plant matter, aquarium water
- **Characteristics:**
  - Microscopic and free-swimming
  - Easily cultured at home
  - Highly digestible
- **Use in ornamental fish:**
  - Ideal first feed for newly hatched fry
  - Enhances early survival rate
  - Suitable for very small mouth larvae



2. Rotifers

- **Scientific name:** *Brachionus* spp.
- **Habitat:** Freshwater and brackish water bodies
- **Characteristics:**
  - Small size (100–300 µm)
  - High reproductive rate
  - Rich in proteins and lipids
- **Use in ornamental fish:**
  - Excellent starter feed for larvae
  - Improves growth and survival
  - Easy to enrich nutritionally

3. Daphnia (Water flea)

- **Scientific name:** *Daphnia magna*
- **Habitat:** Freshwater ponds, lakes
- **Characteristics:**
  - Transparent body
  - Rich in fiber and protein
  - Acts as a natural laxative
- **Use in ornamental fish:**
  - Improves digestion
  - Suitable for juvenile and adult fish

4. Moina

- **Scientific name:** *Moina micrura*
- **Habitat:** Freshwater pools and ponds
- **Characteristics:**
  - Smaller than Daphnia
  - High protein content
  - Fast reproduction
- **Use in ornamental fish:**
  - Ideal for fry and juveniles
  - Enhances growth rate
  - Improves survival under culture conditions

5. Artemia (Brine shrimp)

- **Scientific name:** *Artemia salina*
- **Habitat:** Hypersaline water bodies
- **Characteristics:**
  - Available as cysts
  - High nutritional value
  - Free-swimming nauplii
- **Use in ornamental fish:**
  - Best feed for larval stages
  - Enhances coloration
  - Increases stress resistance

6. Tubifex worms

- **Scientific name:** *Tubifex tubifex*
- **Habitat:** Polluted freshwater, muddy bottoms
- **Characteristics:**
  - High protein content
  - Red, thread-like worms
  - Bottom-dwelling
- **Use in ornamental fish:**
  - Promotes rapid growth
  - Improves breeding condition
  - Highly palatable to fish

7. Blood worms

- **Scientific name:** *Chironomus* larvae
- **Habitat:** Freshwater sediments
- **Characteristics:**
  - Bright red color due to hemoglobin
  - High protein
  - Soft-bodied
- **Use in ornamental fish:**
  - Enhances coloration
  - Improves appetite
  - Useful for conditioning broodstock

8. Earthworms

- **Scientific name:** *Eisenia fetida*
- **Habitat:** Moist soil and organic waste
- **Characteristics:**
  - Rich in protein and minerals
  - Easy to culture
  - Can be chopped for feeding
- **Use in ornamental fish:**
  - Used for large ornamental fishes
  - Enhances growth
  - Improves reproductive performance

9. White worms

- **Scientific name:** *Enchytraeus albidus*
- **Habitat:** Moist soil
- **Characteristics:**
  - Soft-bodied worms
  - High fat content
  - Small size
- **Use in ornamental fish:**
  - Suitable for small fishes
  - Improves conditioning
  - Highly palatable live feed

10. Mosquito larvae

- **Scientific name:** *Culex* spp.
- **Habitat:** Stagnant freshwater
- **Characteristics:**
  - Free-swimming larvae
  - High protein content
  - Easily available
- **Use in ornamental fish:**
  - Enhances growth
  - Improves feeding response
  - Cost-effective live feed

11. Copepods

- **Scientific name:** *Cyclops* spp.
- **Habitat:** Freshwater ponds and lakes
- **Characteristics:**
  - Small crustaceans
  - Rich in essential fatty acids
  - Active swimmers
- **Use in ornamental fish:**
  - Suitable for fry and juveniles
  - Improves growth and vitality
  - Enhances natural feeding behavior

12. Microworms

- **Scientific name:** *Panagrellus redivivus*
- **Habitat:** Cultured media (bread, yeast)
- **Characteristics:**
  - Very small nematodes
  - Easy to culture
  - High protein
- **Use in ornamental fish:**
  - Ideal for early fry
  - Continuous availability
  - High digestibility

13. Vinegar eels

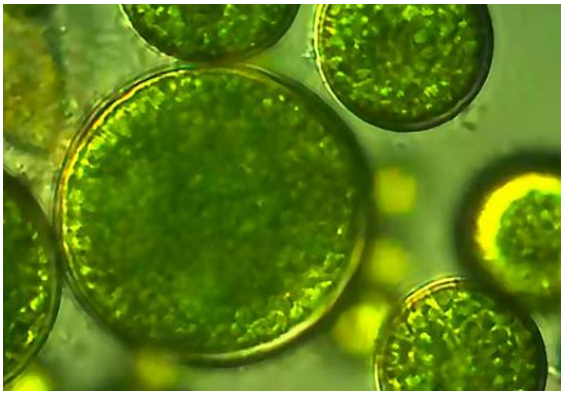
- **Scientific name:** *Turbatrix aceti*
- **Habitat:** Vinegar medium
- **Characteristics:**
  - Microscopic nematodes
  - Free-swimming
  - Easy to maintain
- **Use in ornamental fish:**
  - Starter feed for tiny larvae
  - Improves survival rate
  - Alternative to infusoria

14. Black worms

- **Scientific name:** *Lumbriculus variegatus*
- **Habitat:** Freshwater sediments
- **Characteristics:**
  - Soft and elongated
  - High protein content
  - Long survival in water
- **Use in ornamental fish:**
  - Improves conditioning
  - Suitable for medium-sized fish
  - Highly accepted live feed

15. Algae (Live microalgae)

- **Scientific name:** *Chlorella* spp., *Scenedesmus* spp.
- **Habitat:** Freshwater bodies
- **Characteristics:**
  - Microscopic photosynthetic organisms
  - Rich in vitamins and pigments
  - Improve water quality
- **Use in ornamental fish:**
  - Direct feed for larvae
  - Supports live feed culture
  - Enhances natural coloration



FORMULATED FEED FOR ORNAMENTAL FISHES

Formulated feed plays a vital role in the successful culture and maintenance of ornamental fishes. Unlike live feed, formulated feed is a **balanced, processed diet** prepared by combining various feed ingredients in appropriate proportions to meet the **nutritional requirements** of ornamental fishes at different life stages. Formulated feeds are designed to provide **optimum levels of protein, lipid, carbohydrate, vitamins and minerals**, ensuring consistent growth, enhanced coloration, better health and improved survival. These feeds are available in different forms such as **powder, crumble, pellets and flakes**, depending on the size and feeding habit of the fish. The use of formulated feed ensures **uniform nutrient supply**, reduces dependence on live feed, minimizes disease transmission and allows easy storage and handling. It also helps in maintaining better water quality when compared to unregulated feeding with live or raw feeds.

USES AND IMPORTANCE OF FORMULATED FEED IN ORNAMENTAL FISH

- Provides **balanced and complete nutrition** required for growth and development
- Enhances **body coloration and appearance**, increasing market value
- Improves **feed efficiency and growth rate**
- Reduces the risk of **pathogen introduction**
- Convenient for **storage, transportation and feeding**
- Suitable for **large-scale ornamental fish culture**

NEED FOR FEED FORMULATION

To prepare a quality formulated feed, it is essential to follow a **systematic feed formulation process**. Proper selection of ingredients, processing and pellet formation ensure **nutrient stability, palatability and digestibility** of the feed. The step-wise process involved in the preparation of formulated feed is explained below in the form of a flow chart.

Feed Formulation Flow Chart

Selection of Raw Ingredients

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Cleaning and Sorting of Ingredients

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Grinding / Pulverization

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Sieving (Uniform Particle Size)

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Weighing of Ingredients (as per formulation)

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Mixing of Dry Ingredients

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Addition of Oil, Vitamin and Mineral Premix

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Addition of Water / Binder (Dough Formation)

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Pelletizing / Extrusion

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Drying of Pellets

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Cooling

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Size Reduction (Crumbling for Fry and Juveniles)

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Packaging

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Storage

ALTERNATIVE FOOD AND FEED INGREDIENTS IN ORNAMENTAL FISH FARMING

Types of Alternative Food and Feed Ingredients

1. Plant-Based Feed Ingredients

Plant sources are widely used as alternatives due to their availability and lower cost.

Examples:

- Soybean meal
- Groundnut oil cake
- Mustard oil cake
- Rice bran
- Wheat bran
- Maize flour

Advantages:

- Economical and easily available
- Good source of protein and carbohydrates
- Suitable for formulated ornamental fish feeds

2. Insect-Based Feed Ingredients

Insects are emerging as a promising alternative protein source.

Examples:

- Black soldier fly larvae
- Mealworms
- Silkworm pupae
- Housefly larvae

Advantages:

- High protein and lipid content
- Excellent digestibility
- Environmentally sustainable
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3. Algal and Microbial Feed Sources

Algae and microbes serve as both direct and indirect feed sources.

Examples:

- *Chlorella* spp.
- *Spirulina* spp.
- *Scenedesmus* spp.
- Yeast (*Saccharomyces cerevisiae*)

Advantages:

- Rich in pigments, vitamins and essential fatty acids
- Enhance coloration and immunity
- Improve water quality

4. Animal-Based Alternative Ingredients

Certain animal by-products can be effectively used after proper processing.

Examples:

- Slaughterhouse waste meal
- Poultry by-product meal
- Earthworm meal
- Snail meal

Advantages:

- High protein content
- Improves growth performance
- Reduces dependency on fish meal

5. Agricultural and Household By-Products

Locally available waste materials can be converted into valuable feed resources.

Examples:

- Vegetable waste
- Fruit peels (banana, papaya)
- Brewery waste
- Cooked rice waste

Advantages:

- Low cost and easily accessible
- Supports waste recycling
- Suitable for small-scale farming
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Use of Alternative Foods in Ornamental Fish

- Supplementary feed along with formulated feed
- Direct feeding in small-scale culture systems
- Partial replacement of conventional feed ingredients
- Live feed support and enrichment

Limitations of Alternative Feed Ingredients

- Nutritional imbalance if used alone
- Presence of anti-nutritional factors in some plant sources
- Requirement of proper processing and standardization
- Limited acceptability for some ornamental species

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