

Role of Induced Hormones in Fish Reproduction

S. Deepan Rajesh¹, P. Yuvarajan², N. Imran Mohammed¹, and A. Mohammed Meeran¹

¹UG student, TNJFU - Dr. M.G.R Fisheries College and Research Institute, Thalainayeru

²Assistant Professor, Department of Aquaculture, TNJFU - Dr. M.G.R Fisheries College and Research Institute, Thalainayeru

SUMMARY

Seed availability is an important factor for diversification of any species in the aquaculture. Since the availability of limited/quality seeds from the wild there is an urgent need of seed production through captive maturation and breeding to fulfil the demand. It can be done through the induced breeding method in which an inducing agents play a pivotal role in the fish reproduction and spawning.

INTRODUCTION

The world population is continuously escalating with food demand. Aquaculture is also believed as a possible food production sector to fulfil the food demand through the supply of nutritious diet. It is mainly depending on seed, feed, water quality and management for the successful production. In general, the wild seed collection alone does not fulfil the demand of seed for aquaculture hence captive breeding is a crucial to increase the seed production. Usually, the captive breeding takes place either natural or artificial propagation. Natural breeding is seasonal based that would not supply the expected quantity of seed whereas artificial breeding can supply the seed throughout the year. The present article narrated the importance of inducing agent in fish breeding

Induced breeding

Induced breeding is also known as hypophysation. In this technique, economically valuable fishes are bred by inducing agents through artificial stimulation. Normally, fish breeding occurs during certain periods of the life history with help of reproductive hormones which is regulated by external environmental factors that stimulates the internal mechanisms into action. For instance, the environmental parameters such as photoperiod, temperature, water current and tide influence the hormonal activity from pituitary and gonads. Hence, the hormone induced spawning method which trigger the reproductive function of fish that results release of eggs and sperms for the production young ones. The cost of seed production by induced breeding is very low as compared to the natural resources. So, the induced breeding is quite effective in pisciculture.

Mechanism of induced breeding

It is an artificial process in which the pituitary gland is collected from the mature fish or donor fish and injected into the body of the female and male fishes, as a result, fishes lay eggs and sperms in the pond water and fertilization takes places. This internal mechanism regulates the reproductive function by brain pituitary gonad axis.

Inducing hormones

- Pituitary extracts
- Purified gonadotropins
- Luteinizing hormone releasing hormone (LHRH)
- Steroids
- OVAPRIM
- OVATIDE
- WOVA FH
- OVAPEL

Pituitary extracts

The pituitary gland plays a pivotal role in ovulation and spermiation because which is responsible for the production of gonadotropin hormones (GTH). Injected pituitary material by passes the brain pituitary link acting directly on the ovaries and testes, providing the flow in blood GTH levels that normally precedes spawning. Carp

and salmon pituitary extracts are available at commercial level which are widely used for induced spawning. For example, carp pituitary extracts are used for carp, gold fish and catfish whereas salmon pituitary extracts are used for induced breeding of salmon and trout.

Purified gonadotropins

Human chorionic gonadotropin (HCG) is the most commonly used purified gonadotropin hormone used for induced spawning. The injected gonadotropins act as a natural GTH in fish. Usually, the HCG by pass the brain – pituitary link, acting directly on the ovaries and testes. HCG has been used to spawn fish such as striped bass, white bass, red drum, catfish and mullet. Sometimes HCG alone does not fulfil the better results for some species but when the combination of HCG with common carp pituitary extracts results improved performance.

Luteinizing hormone- releasing hormones

Synthetic LHRH analogs referred as LHRHa or GnRHa which exhibit the potent stimulator effects on ovulation and spermiation of fish. It stimulates the pituitary of fish to produce and release of its own GtH for induced spawning. Atlantic salmon, rainbow trout and common carp can be bred by using LHRH analogs. However, some fish (e.g. Rainbow shark and Gold fish) do not respond to the injections of LHRH alone. Generally, dopamine inhibits the release of hormones from pituitary, effectively blocking the pituitary's positive response to injected LHRHa. In this case, dopamine blockers can be used along with LHRHa as a binder which results positive response to the induced spawning.

Steroids

Sex steroid hormones play important roles at stages of reproductive cycle of fish. The effects of steroid hormones on ovulation are seen primarily as germinal vesicle breakdown (GVBD)GVBD is normally controlled by one or more steroids produced in the ovaries under gonadotropin stimulation, but the timing of ovulation related to that of GVBD varies. The action of pituitary gonadotropins on final oocyte maturation is known to be mediated through steroid hormones. Testosterone, progesterone and estradiol are the example for sex steroids which are used for induced maturation, ovulation, spermiation and sex reversal of fish. However, the residual effect of steroid hormones can adversely affect the environment and biological activities.

Ovaprim

Ovaprim comprises GNRHa and domperidone. It is a potent spermiating/ovulating agent used to promote and facilitate breeding and spawning. It is used to induce maturation within a spawning season and increase milt production including increased sperm count. Ovaprim initiates the reproductive cascade and eliminates the need for a natural trigger whereas the domperidone, the other active component of Ovaprim, helps block the inhibitory effects of dopamine. Domperidone, therefore, is very important for induced spawning of species for which the reproductive cascade would be stopped due to stressors that lead to dopamine release, because dopamine will block GnRH activity

Ovatide

Ovatide comprises of GnRH analogue with dopamine antagonist pimozide. It is cost-effective, gives high fertilization and hatching percentage (85-95%), increases egg production through complete spawning, produces healthy seed, easy to inject due to its low viscosity

WOVA- FH

WOVA-FH comprises of synthetic GNRH, domperidone and glycerol. It gives high fertilization and hatching percentage and long shelf life.

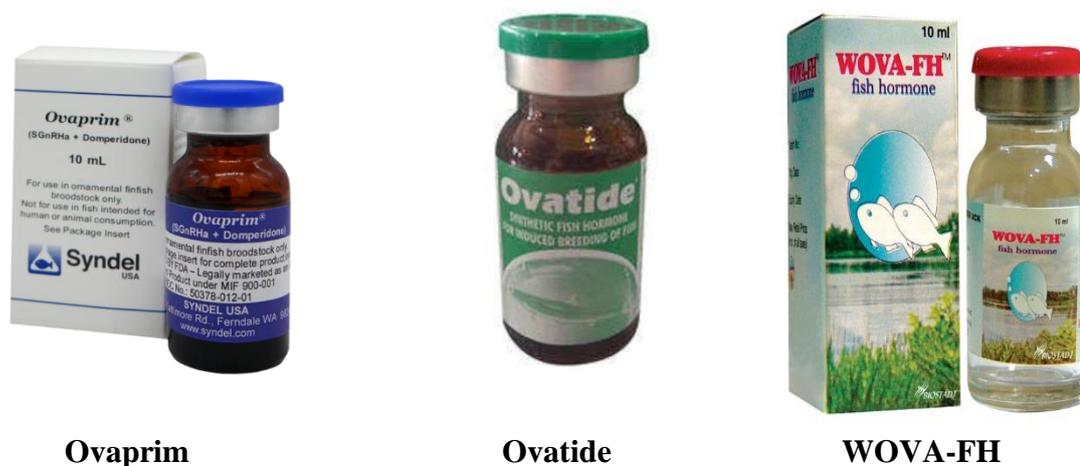
OVAPEL

It comprises of mammalian GnRH analogue and dopamine receptor antagonist, lactosum. The recommended dose for carps is 1-2 pellet/kg of fish. It should be powdered and dissolved in salt solution (0.65% NaCl) 12 hour before planned ovulation then injected in to the abdomen fish

Table 1. Dosage of inducing agents (Ovaprim, Ovatide and Wova-FH)

S. No	Fish	Dosage (ml/kg body wt)	
		Female	Male
1	Catla	0.4 – 0.5	0.1 – 0.3
2	Rohu	0.3 – 0.4	0.1 – 0.3
3	Mrigal	0.25 – 0.3	0.1 – 0.3
4	Silver Carp	0.4 – 0.7	0.1 – 0.3
5	Grass Carp	0.4 – 0.8	0.1 – 0.3
6	Bighead carp	0.4 – 0.5	0.1 – 0.3
7	Fringe-lipped carp	0.3 – 0.4	0.1 – 0.3
8	Catfishes	0.6 – 0.8	0.15 – 0.4
9	Mahseers	0.6 – 0.7	0.2 – 0.3

Synthetic hormones



Ovaprim

Ovotide

WOVA-FH

CONCLUSION

In order to increase the aquaculture production, the continuous seed production is mandate which can be accomplished through induced breeding by using inducing agents. The various inducing agents like ovaprim, ovotide and WOVA-FH could be used with recommended dosage based on the species body weight.

REFERENCES

- Rottmann, R.W., Shireman, J.V. and Chapman, F.A., (1991). *Hormonal control of reproduction in fish for induced spawning* (Vol. 424). Stoneville, Mississippi: Southern Regional Aquaculture Center.
- Yousefian, M. and Mousavi, S.E., (2011). The mechanism of reproduction and hormonal function in finfish species: A review. *Scientific Research and Essays*, 6(17), pp.3561-3570.
- Mishra, R.K., Yadav, A.K., Varshney, P.K., Pandey, A.K. and Lakra, W.S., (2011). Comparative effects of GnRH-based drugs on induced spawning of the freshwater catfish, *Heteropneustes fossilis*.
- Hoga, C.A., Almeida, F.L. and Reyes, F.G., (2018). A review on the use of hormones in fish farming: Analytical methods to determine their residues. *CyTA-Journal of Food*, 16(1), pp.679-691.