PROGRESS IN THE HORMONE SPAWNING OF PONDFISHES IN TAIWAN

by

Yun-An Tang
Tainan Fish Culture Station,
Taiwan Fisheries Research Institute,
Tainan, Taiwan, Republic of China

Present Address: FAO/EPTA Inland Fisheries Biologist
c/o UNDP, Philamlife Building,
United Nations Avenue
P.O. Box 1864, Manila,
Philippines.

ABSTRACT

This is a report on the induced breeding studies on mud carp and striped mullet, as well as use of mixtures of hormones for induced breeding and also studies on carp hybrids, carried out in Taiwan.

INTRODUCTION

Since success was achieved in inducing the Chinese Carps of three major species, the silver carp, *Hypophthalmichthys molitrix* (C. & V.), big-head, *Aristichthys nobilis* (Richard) and grass carp, *Ctenopharyngodon idellus* (C. & V.) to spawn by pituitary hormone injection during their breeding season of 1963 (Tang et al, 1963), the fish culturists of Taiwan have rapidly begun to use this method for large-scale breeding of pond fishes of economic importance. The growing number of hatcheries for the propagation of these fish within the past year indicates that application of hormonal method to breed pond fishes in Taiwan has been taken up on a commercial scale. During the 1964 breeding season, about 5 million Chinese carp fingerlings have been produced by the hormonal method from local hatcheries. This number is about one fourth of the total required by the fish farmers of Taiwan. Many experiments directed toward commercial fish-fry production have been carried out by various fish hatcheries since July, 1963. This report is a summary of available information on the hormone

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breeding of difficult-to-spawn species of pond fishes other than the above mentioned, and on the improved techniques employed in hormone treatment of the spawners, the hatching of the fertilized eggs and the care of the hatchlings.

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Induced Spawning of Mud Carp, *Cirrhina molitorella* (C. & V.)

The mud carp is one of the Chinese major carps cultivated in the central part of Taiwan. The total number of mud carp fingerlings required by the local fish farmers is approximately 3 million per year.

The induction of spawning of the mud carps by the injection of hormonal materials has been previously described by Lin (1964). The techniques for spawning the mud carp is almost identical with that of silver carp, big-head and grass carp, except that, in Lin's experiments, mud carps are positively responsive to heteroplastic injection. Lin has injected pituitary extracts of skipjack tuna *(Katsuwonus pelamis)*, into the carps with positive results. Injection of 500 rabbit units of cattle anterior lobe extract combined with fresh toad pituitaries has also been tried with positive results. Under the influence of exogenous gonadotrophin on cool, rainy days, mud carp spawned in the holding ponds and the eggs were fertilized by milt shed by the males. In experimenting with the big-head or grass carp, however, due to the difficulty in furnishing a suitable environment for the mating activity of these large-size fish, and due to difficulty in arriving at the correct dosage of hormones to both sexes of the limited number of recipients at the same time, natural fertilized eggs were never found in the holding ponds with one hundred odd pairs of experimental fish. Lin has noticed that an excellent viability of the naturally fertilized eggs was obtained from a lot of hormone-spawned mud carp in a heavy storm during September 1963.

Induced Spawning of Striped Mullet, *Mugil cephalus* Linn.

The demand of striped mullet fingerlings for stocking both fresh and brackish water ponds in Taiwan is estimated at 10 millions per year. These fingerlings are supplied by fishermen who collect them from the esturine water along the coast in the months from December to March.

Experiments conducted by Tang and his associates (1964) during the mullet fishing season (November-January) of 1963 indicates that application of hormonal method will bring about the striped mullet to breed during their spawning migration to the south-western coast of Taiwan. According to Tang's experience, only the females need to be injected and the threshold dosage for precipitating ovulation of a female striped mullet is at the level of two mullets pituitaries combined with 40 rabbit units Synahorin (a mixture of chorionic

gonadotrophin and mammalian hypophysial extract). The greatest difficulty for hormone treatment of this species of fish, as described by Tang, is the high mortality of the test fish during captivity. Most of the striped mullets appeared to be in poor condition when they had been held in captivity for 24 hours, and none were able to withstand confinement for over 86 hours. Rearing of the hatchlings is also difficult for this species. Tang and his associates failed to rear the mullet hatchlings beyond the postlarval growing stage during the 1963 experiments.

Increase of Ovulating Effectiveness of Fish Pituitary by Combination of Chorionic Gonadotrophin

A review of the response of Chinese carps to pituitary hormone injection reveals varying degrees of success and failure. With similar techniques, of the 33 spawners that received the treatment, 22 recipients, or 66% showed negative response (see Tang et al, 1963). For improvement of the results, experiments with fish pituitary combined with chorionic gonadotrophin to increase its effectiveness may yield valuable results, since it is generally well known that the chorionic gonadotrophin resembles the luteinizing hormone in its action and the chorionic gonadotrophin used in this case could increase the luteinizing hormone-like properties of the fish pituitary. Actually, many recent research in medicine indicate that preparations composed of a mixture in a certain ratio of the anterior lobe of mammalian pituitary and chorionic gonadotrophin show stronger action than either of these materials applied individually, and many of these preparations are now available in the market.

Results obtained from the experiments conducted by the staff of the Station (Liu, 1963 and Tang et al, 1964) indicate that injection with fish pituitaries combined with minute doses of chorionic gonadotrophin shows stronger action than with fish pituitary alone for bringing about ovulation in Chinese carps and striped mullets. There are a number of brands of chorionic gonadotrophin available in the market. The preparations tested by us are Puberogen (contain 250 IU/ml. of chorionic gonadotrophin), Gonagen and Synahorin (either of these preparations contains chorionic gonadotrophin mixtured with a certain amount of mammalian pituitary extract). Results of the 1964 experiments showed that, of the 91 spawners of the Chinese carps that received the preparation of fish pituitaries combined with chorionic gonadotrophin, 78% showed positive response. This is an increase of 45% as compared with the results obtained when chorionic gonadotrophin was not added. This increase of positive response can be attributed to the combined effect of fish pituitary and chorionic gonadotrophin, either synergistic or possible additive.

Expediting Spawning of Chinese Carps before the Normal Breeding Season

The spawning season of Chinese major carps in their native habitats on the China Mainland is April to July. Spawnings usually take place when the river rises after heavy rains. The spawning season of these carps outside their native habitat,

in Taiwan and Japan as reported respectively by Tang (1960) and Kuronuma (1954), is during the typhoon months, June-August. The environmental conditions of the spawning grounds in these areas approximate those of their native habitats.

Liu (1964) has demonstrated that silver carps can be made to spawn by hormone injection as early as two months before the normal typhoon season sets in. This early spawning of Chinese carps by hormone injection offers advantage to fish farmers as the fingerlings can be supplied earlier and thus the growing season of these fish in ponds can be prolonged.

Development of Circular Hatching pond

After fertilization and full swelling in the water, the eggs of the Chinese carps are demersal and quite free and separate. They resemble somewhat the eggs of Salmon and other species of anadromous fishes. But due to the fragile outer membranes and the lower specific gravity of the eggs of Chinese carps, the established hatching techniques and equipment for the salmon and trout are usually unsuitable for the Chinese carps. Under natural conditions, these eggs are carried by the flowing water during hatching. This enables the eggs to roll smoothly on the upper layer of the flowing water and free themselves from suffocation by covering with mud and other small particles. The circular, or round hatching ponds have been developed on this principle. The fundamental design is a circular basin in which a steady stream flows round and round, and eventually the water flows over through an opening in the center. Successful hatching has been obtained from these ponds.

Hybridization of Chinese Carps

Hybridizing of male *H. molitrix* with the female *Cyprinus carpio* has been reported by Kuronuma (1954), but the hybrids died during the larval fish stage. Similar result has been obtained by crossing of male *C. idellus* with female *Labeo rohita* (Alikunhi et al, 1963). Alikunhi and his associates (1963) have also experimented on hybridization of the *H. molitrix* ♂ x *L. rohita* ♀, *H. molitrix* ♂ x *Catla catla* ♀, *C. catla* ♂ x *C. idellus* ♀, *L. rohita* ♂ x *C. idellus* ♀, and *C. catla* ♂ x *H. molitrix* ♀, but the embryos obtained died immediately after hatching. Although most of the hybrids obtained from these crossings have not grown to fry or fingerlings, the results are encouraging and interesting to fish culturists, as it would be possible to develop the improved strains of these species by hybridization.

The successful hybridization of male *H. molitrix* with the female *A. nobilis* and male *A. nobilis* with the female *H. molitrix* has produced thousands of fingerlings which are now growing well in the ponds of the Station. Lin (1964) reported the crossing of *C. molitorella* male with both the females of *C. carpio* and *C. asuratus* and the production of considerable number of fingerlings. Those obtained from the crossing of *C. molitorella* and *C. carpio* have

grown to an average size of 1.35 kg. (ranging from 1.2 to 1.5 kg.) during a period of one year in an ordinary fish pond. A program of hybridization of Chinese carps in an attempt to develop superior strains of these species of fish is being undertaken by the Station.

Feeds and Feeding of the Chinese Carp Hatchlings

Tang et al (1963) suggested that artificial feeding of the Chinese carp hatchlings should be started from the time 48 hours after they emerge from the egg capsules (water temperatures of the nurseries 27° 31°C.). This is because the hatchlings generally begin to take the protozoa and micro-algae as food from this time. Experiments on artificial feeding of these hatchlings with wheat flour, peanut cake meal, rice bran, soybean milk and the yolk of boiled duck eggs showed that the last two materials in the list gave better results than the others. Further experiments with soybean milk combined with parts of duck egg's yolk resulted in better growing and higher survival of the hatchlings than any of the other materials used individually. The protozoa, consisting of the main group *Ciliata* and micro-crustaceans with dominant group *Daphnidae*, seem to be important for the growth and survival of the Chinese carp hatchlings in the nurseries. However, there has been no experiment to make a comparision between the natural foods (protozoa and microcrustaceans) and the artificial feeding stuffs in relation to the growth and survival of the Chinese carps of the larval stage.

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