

INDUCED SPAWNING OF KOI CARP*

DRAGANA LJUBOJEVIĆ, DANIEL MATULIĆ, NIKOLINA NOVAKOV,
MIROSLAV ĆIRKOVIĆ, SNEŽANA SIMIĆ, VLADICA SIMIĆ¹

SUMMARY: Artificial spawning is the most effective and the most reliable method of eggs and fingerlings production, and control of infectious and parasitic diseases. The aim of this study was to investigate the possibility and efficiency of out-of-season induced spawning of KOI carp, the impact of body mass of females on the number of eggs, as well as the correlation between the percentage of migrated oocysts and spawning success. To induce and synchronize ovulation and spermiation by hormonal stimulants, fish receive injection of pituitary gland, calibrated pituitary extract or a synthetic GnRH. In our trial of induced spawning of carp, we used cCPE because of winter time and out-of-season spawning. There was significant correlation ($F=0.709$) between the body weight of the female to the weight of eggs and a significant correlation ($F=0.642$) between the body weight of the female and the number of the eggs. We found negative correlation ($F = -0.530$) between the percentage of migrating oocytes to spawning success. We assume that the reason can be related due to environmental circumstances, as well as the quality of spawners. Even though the percentage of spawning was lower than normal percentage of spawning for carps we had satisfactory success because it was done out of season.

Key words: induced spawning, KOI carp, cCPE, off-season spawning, females, milt, eggs.

INTRODUCTION

Induced spawning is the most effective and the most reliable method of eggs and fingerlings production, and control of infectious and parasitic diseases. Controlled

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¹Dragana Ljubojević DVM, research associate, Nikolina Novakov Mr, teaching assistant, Miroslav Ćirković PhD, professor, Faculty of Agriculture, Novi Sad. Daniel Matulić Mr, teaching assistant, Faculty of Agriculture, Zagreb, Croatia. Snežana Simić PhD, associate professor, Vladica Simić PhD, professor, Faculty of Sciences, Kragujevac.

Corresponding author: Dragana Ljubojević, Faculty of Agriculture, 21000 Novi Sad, Serbia; E-mail: ljubojevicd@yahoo.com, Phone: +381 21 510-606.

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spawning began around the year of 1725 when L. Jacobi succeeded to control fertilization of eggs of salmon and trout (Nesh et al., 2011). The major breakthrough in fish breeding came with the finding that dopamine acts as inhibitory factor for synthesis of gonadotropin (Zohar and Mylonas, 2001). This breakthrough led to the development of the artificial spawning. Common carp matures in subtropical climate zone in six months (Brzuska and Bialowas, 2002). An adult common carp may spawn four or five times per year in subtropical conditions if temperature is maintained at 20 to 22°C (Horvath, 1986; Chemineau, 2007). Diversity of fish reproductive strategy involves diversity in the timing of fish spawning (Webb and McLay, 1996). Thus, it occurs in late spring to summer in carp in Europe (Brzuska, 2004). In Israel the spawning seasons starts with common carp at the end of February and the beginning of March, when the water temperatures reach 19-21°C (Brzuska and Bialowas, 2002). Since the middle of 1980s, hypophysation has improved through the introduction of standardized dry carp pituitary extract in which the luteinizing hormone (LH) content and activity have been calibrated (calibrated carp pituitary extract = cCPE) (Yaron et al., 2009). Approximately 300 000 to 800 000 newly hatched fry can be expected from a single female (Ćirković et al., 2002; FAO, 2006). The aim of this study was to investigate the possibility and efficiency of out-of-season induced spawning of KOI carp, the impact of body mass of females on the number of eggs, as well as the correlation between the percentage of migrated oocysts and spawning success.

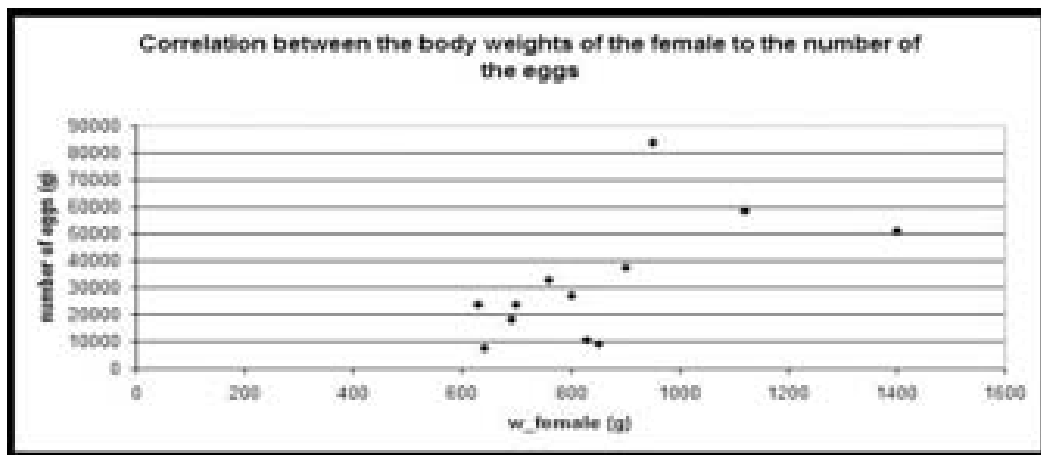
MATERIAL AND METHODS

The spawning was done at Gan Shumel Fisher Hatchery and Breeding Centre in Israel in December. Thirty females KOI-carp (*Cyprinus carpio L.*) were placed in 10 plastic tanks, cca 450 liter. Carp males were kept in separated ponds of carp females brood fish, in order to avoid uncontrolled reproduction. The brood fish were kept in water saturated with oxygen, within the temperature range of 20-24 °C. The tanks were covered with a net, to prevent the fish from jumping out of the tank. From each tank, one female was biopsied. Females were anesthetized by 99% 2 phenoxyethanol and the biopsy of ovary was done via genital opening by inserting a 3 mm plastic catheter into the gonad. Carp eggs are opaque and the only way to examine the position of GV (germinal vesicle) under the binocular microscope is to make them transparent. The ovarian sample (of about 100 oocytes) was cleared in SERA solution (ethanol 60%, formalin 30% and acetic-acid 10%). Within 3 min the oocytes became translucent and remained so for an additional 5 min. The position of the germinal vesicle and ripeness of female was determined and the number of oocytes at each stage was recorded. Total weight of all females was calculated and it was around 40 kg. Hormones for injection were prepared for all fish together. 10 ml of 0,9%NaCl saline was added to marked vial with "10 kg of CPE" (CPE-carp pituitary extract) and was mixed by hand. Final concentration was 1 kg/ml for each kg of fish that was injected with 1 ml of solution. The dose of hormones was divided in two doses. After the anesthesia of the fish, around 11 00h, intramuscular injection of cCPE hormone was given in the base of the dorsal fin - priming injection. Around 24 00 h fish received a second - inducing injection. The area of injecting was gently massaged followed with the withdrawal of the needle after injection to aid distribution of the extract into musculature and prevention of its backflow. 10 males were injected with 70% of the dose CPE that used for females. The day after, the

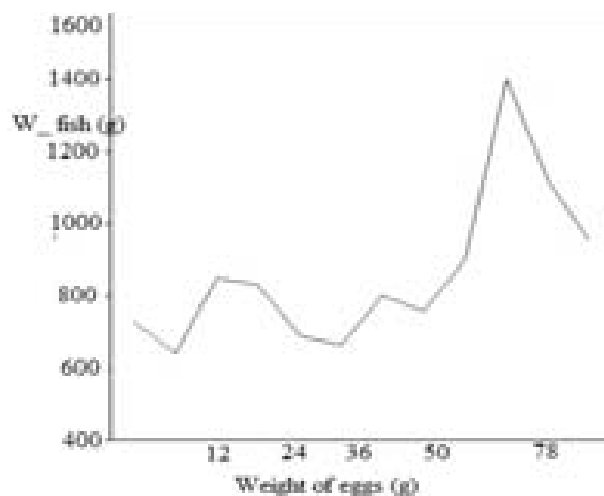
spawning was occurred little bit later than we expected. Eggs were gently squeezed in the dry bowl and letter a small volume of sperm was added and mixed carefully together „the dry method“. Physiological solution-saline was used to prolong the fertilization and rinsing solution (dilution of milk) to remove the stickiness of common carp eggs was added afterwards. Incubation was carried out in Zoug jars. For statistical analyses of correlations were used SPSS for Windows and Excel (MS Office).

RESULTS AND DISCUSSION

With total number of fishes $n = 30$ and number of spawned females $n = 13$ spawning success was 43.33 %.The Spearman’s correlating coefficient between body weight of fish and number of the eggs was measured (Graph 1), correlation between body weight of fish and weight of eggs (Graph 2) and the correlation between the % of migrating oocytes to spawning success (Graph 3). In correlation between the percent of migrating oocytes to spawning success, only eight of the females with biopsy were spawned.

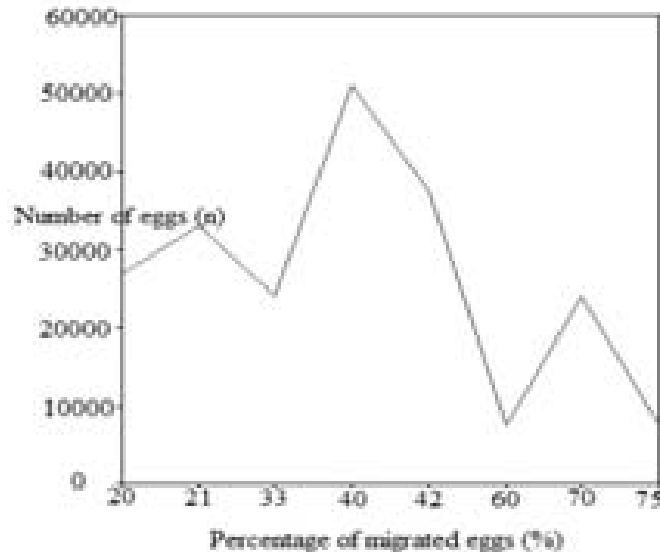


Graph 1. Correlation between the body weights of the females to the number of the eggs
Grafik 1: Korelacija između telesne težine ženki i broja jaja



Graph 2. Correlation between the body weight of the female to the weight of eggs
Grafik 2: Korelacija između telesne težine matica i mase jaja

There was a significant correlation ($F=0.709$) between the body weight of the female to the weight of eggs and a significant correlation ($F=0.642$) between the body weight of the female to the number of the eggs. We found negative correlation ($F = -0.530$) between the percentage of migrating oocytes to spawning success which contradict with many spawning researches.



Graph 3. Correlation between the % of migrating oocytes to spawning success
Grafik 3. Korelacija između % migriranih oocista i uspešnosti mresta

We assume that the reason can be related to environmental circumstances, as well as the quality of spawners. To induce and synchronize ovulation and spermiation by hormonal stimulants, fish receive injection of pituitary gland, calibrated pituitary extract or a synthetic GnRH (Arabaci et al., 2004; Dorafshan, 2003). It is recommended to use cCPE at the beginning and end of the spawning season when the LH content in the pituitary is low and synthetic GnRH in mid-season and in field spawning. (Yaron et al., 2009). In our trial of induced spawning of carp, we used cCPE because of winter time and out off-season of spawning. Concerning hatching performance, hatching rate of 43.33% was slightly lower compared to 95% reported by Horvath and Lukowicz (1982) and 88% reported by Kucharczyk et al. (2008). Latency time is also highly dependable on water temperature. The latency time of our treated carps was little postponed due to small system heating error. Even though the percentage of spawning was lower than normal percentage of spawning for carps we had a satisfactory success because it was done out of season. The carp pituitary extract (CPE) has been used in most hatcheries, however the increased production targets and the cost of this biological material led to consider alternative approaches (Yaron, 1995).

CONCLUSION

Concerning hatching performance, hatching rate of 43.33% was slightly lower compared to results reported by others. This could be attributed to immaturity of some individuals, since the experiment was performed before the reproductive period, in order to secure the spawning response in fully mature fish. The recognition of the best

moment for applying hormonal induction in cyprinid artificial spawning is very important. Before any action on fish is taken, they must be anesthetized and handling must be done very gently. Even though the percentage of spawning was lower than normal percentage of spawning for carps we had a very big success because it was done out of season.

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INDUKOVANI MREST KOI ŠARANA

DRAGANA LJUBOJEVIĆ, DANIEL MATULIĆ, NIKOLINA NOVAKOV,
MIROSLAV ĆIRKOVIĆ, SNEŽANA SIMIĆ, VLADICA SIMIĆ

Izvod

Veštački mrest predstavlja najefikasniji i najpouzdaniji metod za proizvodnju ikre i ribljeg podmladka i za sprečavanje pojave infektivnih i parazitskih bolesti, koje se prenose sa roditelja na potomstvo. Cilj rada je bilo ispitivanje mogućnosti i efikasnosti vansezonskog indukovanog mresta KOI šarana, uticaja telesne mase ženki na broj jaja, kao i utvrđivanje korelacije između procenta migriranih oocista i uspešnosti mresta. Da bi se indukovala i sinhronizovala ovulacija i spermatogeneza kod riba, koriste se injekcije hormona hipofize, kalibrisani ekstrakt hipofize ili sintetički GnRH. U sprovedenom ogledu, korišćen je cCPE zbog zimske sezone i vansezonskog mresta. Uočena je značajna korelacija ($F=0,709$) između telesne mase matica i mase ikre i značajna korelacija ($F=0,642$) između telesne mase matica i broja jaja. Negativna korelacija ($F=-0,530$) između procenta migriranih oocista i uspešnosti mresta je u suprotnosti sa mnogim ranijim istraživanjima. Petpostavka je da bi razlog ovome mogao biti u faktorima okoline, kao i u kvalitetu samih matica. Iako je procenat izmrešćenih matica bio niži od uobičajenog procenta uspešnosti veštačkog mresta šarana, uspešnost je ipak bila zadovoljavajuća s obzirom da je mrest izvršen van uobičajene sezone.

Ključne reči: indukovani mrest, KOI šaran, cCPE, vansezonski mrest, matice, mleč, jaja

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