Fishery Technology
2003, Vol. 40(2) pp : 101 - 104

Evaluation of a Few Locally Available Anaesthetics for Potential Use in Fish Seed Transportation

S.K. Das and U.C. Goswami*
Assam Agricultural University, College of Fisheries, Raha, Nagaon - 782 103, Assam, India

A study was conducted to explore the possibility of using a few locally available anaesthetics, thiopentone sodium, xylodac, lignocaine and sodium chloride for fish seed transportation. Application was made by inhalation of anaesthesia where by the drugs, in aqueous solution, entered the arterial blood during ventilation of the gills. The study revealed that the mixed seeds of major carp (*Labeo rohita, Cirrihinus mrigala and Catla catla*) of average length 2.8 cm could be transported safely in a solution containing thiopentone sodium @15 mg/L of water for more than 30 min without oxygen. In the case of lignocaine, 10ml/L gave the best result with a recovery time of 14 min; whereas, 4ml/L of xylodac was found to be effective for fish fry with a mean survivability of 90%. The anaesthetics were found to reduce the activity of the fish fry in the aqueous solutions of the sedative agents. The study indicates the possibility of utilizing these compounds for short duration fish seed transportation.

Key words: Anaesthetics, fish seed, transportation

In modern live-fish transportation technique, the use of sedatives finds an important place. The anaesthetics lower the metabolic activity of fish, which facilitates the transport of more fish in a given quantity of water for a long time. In recent times anaesthetizing chemicals have been used in the transporting medium of fish seeds and adult fish. It has also been proved that anaesthetics make the otherwise time consuming work of handling, weighing, marking, tagging, fin clipping, stripping and operative procedures much easier and also lower the mortality of fish due to handling and transport (Saxena, 1986). Only the liquid and solid anaesthetics, especially those, which are readily soluble in water, are useful in this field.

Very little published information is available on sedation of tropical cultured fish species (Lindsay and Geddes, 1979; Lindsay *et al.* 1999; Basavaraj *et al*, 1998). Especially information on use of thiopentone - sodium, xylodac, lignocaine and sodium chloride as anaesthetics/sedative agents are scanty (Saxena, 1986; Johnson and Metcalf, 1982) Therefore, a preliminary study was undertaken to evaluate these anaesthetics for potential use in carp seed transportation. The Indian major carp (*Labeo rohita, Cirrihinus mrigala* and *Catla catla*) seeds were used as the model species.

The basic objective of the study was to explore the possibility of using a few locally available anaesthetic drugs for fish seed transportation. The study investigated the application of thiopentone sodium, lignocaine and xylodac by inhalation of anesthesia where by the drugs, in aqueous solution, enters the arterial blood during ventilation of the gills.

Materials and methods

Thiopentone – sodium which is a mixture of 100 parts of mono-sodium salt of thiopentone sodium (Intraval sodium – May & Baker Co), a 5 – ethyl – 5 – (1 methyl butyl) – 2 – thiobarbituric acids and 6 parts of exsiccated sodium carbonate, is used extensively as ultra-short acting anaesthetic in human and veterinary surgery. The thiopentone powder is highly soluble in water.

Lignocaine hydrochloride injection I.P 2% is manufactured by Socrus Pharmaceutical Ltd, Mumbai. Each ml contains lignocaine hydrochloride I.P.2% w/v and

* Department of Zoology, Gauhati University, Guwahati – 781 014, Assam

methylparaben I.P.0.1%w/v as preservative. It is available in liquid form and is easily soluble in water. Lignocaine reduces the water pH.

Xylodac-vet (manufactured by agrivet division of Cadila, Ahmedabad) is an effective sedative, analgesic, anaesthetic and muscle relaxant in all-domestic and wild animals. Each ml of xylodac contains 20 mg of Xylazine hydrochloride, Methylparaben I.P. 0.15%w/v, Propylparaben I.P 0.02%w/v (as preservatives) and water for injection. The drug is soluble in water.

Commonly cultured Indian major carp (*Labeo rohita, Cirrihinus mrigala* and *Catla catla*) seeds (fry stage) were collected from a local hatchery. The fish seeds were given exposure to different anaesthetics at varying concentrations. For this they were placed in a bath with added anaesthetic and removed after loss of equilibrium. The anaesthetized fish were then transferred to freshwater for recording recovery. The required quantity of each drug was weighed and was dissolved in measured quantity of tap water in 1L capacity glass jars. For each chemical, several concentrations were prepared for the experiment to evaluate their effectiveness. The technique followed was as that of Billard (1981).

Results and Discussion

Several doses of thiopentone sodium, lignocaine, and xylodac were tried to anaesthetise 1 day starved Indian major carp fry. In fresh water medium, the fry took different times (depending on the concentrations of the drug) to recover to the normal state. During the sedation period, the rate of opercular movement as well as metabolic activity of fry decreased which clearly signifies the reduction in the rate of oxygen consumption. But as soon as they recovered there was a marked increase in the rate of opercular movement. The results of the studies are given in Tables 1, 2 & 3. As seen from the tables the higher the concentration of the drug the lower the percentage of survival. But no abnormalities in the reaction of fry were recorded in this study. Different concentrations of anaesthetics on carp showed that the respiratory rate in experimental fish is reduced following anaesthesia with thiopental sodium.

In the case of lignocaine 10ml/L was found to be optimal with 100% mean survivability, whereas 4ml/L of xylodac gave encouraging result with mean survivability of 90%. In the case of sodium chloride, 4mg/L was found to be the optimal dose with 95% mean survivability recorded after 36 h. It was observed that the treated fry when transferred to fresh water remained sluggish and stayed at the bottom of the experimental jars. After recovery, the fry became active and within a few minutes normalcy was attained. The recovery time was recorded after they attained full normalcy, as shown in Tables 1, 2 & 3.

Table 1. Effect of Thiopentone – sodium on major carp fry.

Parameters	Control	10 mg/L	15 mg/L	20 mg/L
Size of fish fry (cm±SD)	3.30±0.47	3.30±0.47	3.30±0.47	3.30±0.47
Water temperature (^{0}c)	23.5	24.0	24.5	24.0
Water pH	7.6	7.5	7.6	7.6
Stocking density (no./L)	100	100	100	100
Mean Time taken to respond (min)	-	4	3	1
Mean Time taken to recover (min)	-	18	32	25
Mean Survival (%) after 8 hrs	100	100	90	60

*Correlation coefficient: r = -0.98, r= 0.50 and r = -0.96

The study revealed that the major carp's advance fry of average total length 2.8 cm could be transported safely in a solution containing thiopentone sodium at 15 mg/L of water for more than 30 min without oxygen packing. This drug is advantageous for its convenient administration and rapid action as reported in veterinary surgery (Collins, 1972). The results have shown a possibility of using this drug for fish seed transportation. Thiopental sodium at a concentration of 0.05 g/L was not found to have toxic effect on carp under-yearlings (Strebkova, 1972). Saxena (1986) reported that a concentration of 50mg/L of thiopentone was found to be safe for fingerlings of mrigal (*Cirrihinus mrigala*). The effect of anaesthesia was felt within 5-6 min. The recovery was within 55 min at this concentration. A lower dose of thiopentone gave the best result for the fry of Indian major carp indicating a

Table 2. Effect of different doses of Lignocaine on major carp fish fry.

Parameters	Control	4ml/L	5ml/L	6ml/L	10ml/L	20ml/L
Size of fish fry (cm±SD)	3.05±0.46	3.05±0.46	3.05±0.46	3.05±0.46	3.05±0.46	3.05±0.46
Water temp^r (^{0}c)	23.7	23.5	23.5	23.8	23	23.5
Water pH	7.9	7.9	7.9	7.9	7.9	7.9
Stocking density (no./L)	100	100	100	100	100	100
Mean Time taken to respond (min/sec)	-	3m	2m 20sec	2m15sec	1m30sec	Dead
Mean Time taken to recover (min)	-	4	7	11	14	Dead
Mean Survival (%) after 8 hrs	85	100	90	87.5	100	0

*Correlation coefficient: r = -0.95 and r = 0.92

relationship between size of the fish and dosage. Size of the fish is one of the most important factors, which influences the changes in the rate of induction and the depth of anaesthesia (Durve and Dharma Raja, 1966). When the concentration of the thiopentone-sodium was increased (Table1), time required to respond decreased indicating a negative correlation (r = -0.98). However, a positive correlation (r = 0.50) was obtained between the dose tried and time required to recover. Further, as dose increased the survival percentage decreased, which indicated a negative correlation (r = - 0.96).

Lignocaine (10ml/L) gave the best result with a recovery time of 14 min.

Table 3. Effect of different doses of Xylodac on major carp fish fry.

Parameters	Control	1ml/L	4ml/L	10ml/L
Size of fish fry (cm±SD)	3.30±0.47	3.30±0.47	3.30±0.47	3.30±0.47
Water temp^r (^{0}c)	24.6	23.8	24.5	24.0
Water pH	7.9	7.9	7.9	7.9
Stocking density (no./L)	100	100	100	100
Mean Time taken to respond (min/sec)	-	3m	1m 40sec	1m 40sec
Mean Time taken to recover (min)	-	16	31	27
Mean Survival (%) after 8 hrs	85	85	90	55

*Correlation coefficient: r = -0.94

However, a dose of 20ml/L of lignocaine was found to be toxic to the fish fry. The trial with this dose resulted in instant mortality of the major carp fry. When the dose of lignocaine is increased, fish fry took more time to recover indicating significant correlation (r=0.92). However, when the dose of lignocaine increased, time required to respond by the fish fry decreased (r= -0.95). Lignocaine was found to reduce the pH of the aqueous solution from 7.9 to 7.5.

Out of the three doses tried, 4ml/L of xylodac was found to be effective for fish fry with a mean survivality of 90%. The fish fry recovered fully in 31 min (Table 3). When the dose of xylodac increased, time required to respond by the fish decreased (r= -0.94). However, no trend was observed between the dose tried and the survival percentage. Rodriguez and Esquivel (1995), reported sedation time in common carp of approximately 2.17 min using xylocaine.

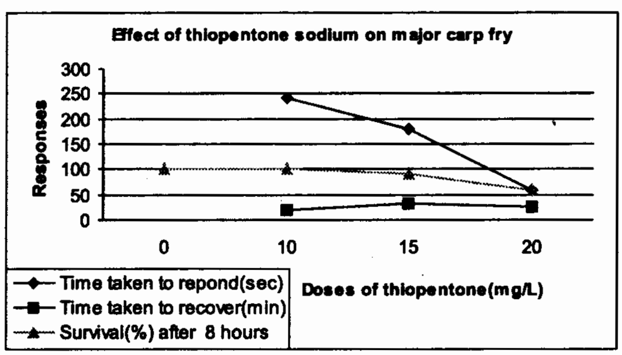

Fig. 1. Effect of thiopentone sodium on major carp fry

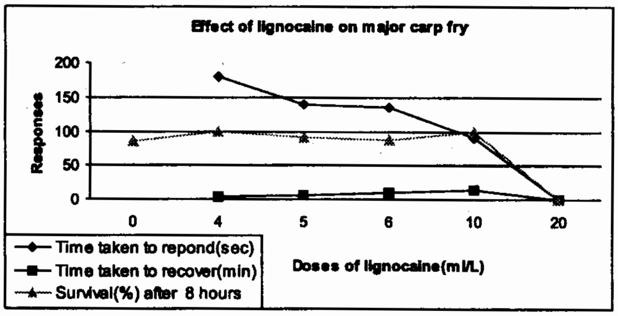

Fig. 2. Effect of lignocaine on major carp fry

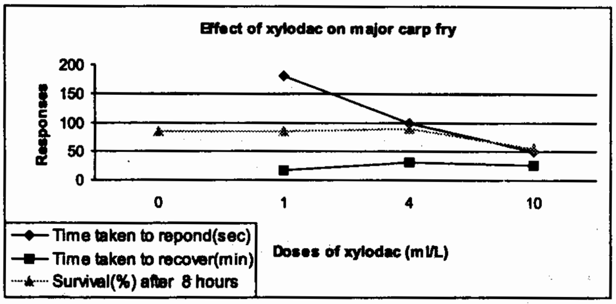

Fig. 3. Effect of xylodac on major carp fry

In the present experiment all deaths occurred when fish failed to recover from anaesthetisation and there were no deaths subsequent to recovery. The recovery rates were comparable with those recorded for other anaesthetics. Excessive dosage or prolonged exposure affects the medulla leading to paralysis of the vital respiratory and vasomotor centres, which ultimately causes death (Mc Farland, 1959). Basavaraju *et al*, 1998 report that in the transportation of live fish the limiting factors are dissolved O_2, CO_2 activity waste products and temperature. Sedation reduces not only the activity but also O_2 consumption, ultimately resulting in the reduction of CO_2 activity and waste products. Anaesthetics, therefore, have the potential of directly controlling one factor and partially others, which gets implicated in the mortality of fish during transport.

All the sedative agents evaluated under the present study are cheap and available locally and have proved their potency on fish seed. Further studies could be undertaken on standardisation of dose for different stages of fish and its effects on fish growth.

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