

Effect of Clove Oil as an Anaesthetic on The Fry of Fishes, Silver Dollar (*Metynnis schreitmulleri* Ahl), Sword Tail (*Xiphophorus helleri* Heckel) and Pearl Gourami (*Trichogaster leeri* Bleeker)

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Abstract

Efficacy of Clove oil as an anesthetic was examined on the fry of ornamental fishes Silver dollar (*Metynnis schreitmulleri* Ahl), Swordtail (*Xiphophorus helleri* Heckel) and Pearl gourami (*Trichogaster leeri* Bleeker) in order to slow down the movement for short duration while handling for scientific studies. The two sized groups (A and B) of each fish with eight concentrations (10, 20, 30, 40, 50, 60, 70 and 80 mg l⁻¹) of clove oil were tested. The fry of Silver dollar in the group 'A' having average size of 3.50±0.01 cm indicated 38.66 ±0.33 and 268.33± 4.40 seconds as induction and recovery times, while in the group 'B', fry with average size of 6.00±0.02 cm, the induction and recovery times were 50.00 ± 0.57 and 371.00 ± 6.00 seconds respectively when treated with 80 mg l⁻¹ concentration of clove oil. The induction and recovery times in respect of both the groups of Sword tail fry were 285.33±0.33, 379.00 ± 0.57, 187.00 ± 0.57 and 98.33± 0.3 seconds respectively when exposed to 80 mg l⁻¹ concentration. A positive dependence was observed between fish length, induction and recovery time. However, there was no effect of any clove oil concentration as an anesthetic on the fry of both size groups of Pearl gourami. The concentration of 80 mg l⁻¹ of the clove oil observed to have quick induction of sedation on Silver dollar and Swordtail in shortest duration.

Keywords: Clove oil, anesthetics, transportation, *Metynnis schreitmulleri*, *Xiphophorus helleri*, *Trichogaster leeri*

Introduction

Clove oil has been used for a number of years to anaesthetize fishes in seawater (Patrick and Adeline, 2000) and best-known local anesthetic in dental sugary. Clove oil is distilled from *Eugenia caryophyllata* stems, buds and leaves. The active ingredients are phenol derivatives essentially the C₁₀H₁₂O₂ euganol compound (Taylor and Roberts, 1999). The effects of clove oil as an anesthetic were studied by researchers on marine and fresh water fishes (Keene *et al.*, 1998; Patrick and Adeline, 2000 and Woody *et al.*, 2002).

Materials and Methods

The commercially available clove oil mixed with 3-4 volumes of ethanol to make it water-soluble. Eight concentrations (10, 20, 30, 40, 50, 60, 70 and 80 mg l⁻¹) of this mixture were tested on two different sized (Group-A and B) fry of Silver dollar, *Metynnis schreitmulleri* Ahl (3.50 ± 0.01cm, 6.00 ± 0.02 cm); Sword tail, *Xiphophorus helleri* Heckel (2.82 ± 1.48 cm, 6.15 ± 1.13cm) and Pearl gourami, *Trichogaster leeri* Bleeker (3.90 ± 0.45 cm, 6.50 ± 0.25 cm). The range of concentrations was selected on the basis of the results reported by Woody *et al.* (2002). During this procedure guidelines recommended by Hicks (1989) were followed. The experiments were conducted in triplicate in glass aquaria 15"x12"x12" containing 3 l water. Induction

time and recovery time were recorded. The water temperature was 28.5±1.0 °C throughout the experiment.

Results and Discussion

The results of induction time and survival percentage of both groups of Silver dollar and swordtail fishes exposed to eight clove oil concentrations are presented in Table 1. There was significant difference (P < 0.05) among the treatments for induction and recovery times in both groups. The Silver dollar fry of group-A treated with 80 mg l⁻¹ showed quick induction *i.e.* 38.66 ± 0.33 seconds with recovery time of 268.33 ± 0.40 seconds (Table 1). There was no effect of 10 mg l⁻¹ concentrations on the induction of both sized Silver dollar fishes. The induction time in respect of group-A Silver dollar fishes was not significantly different (P > 0.05) between 70 and 80 mg l⁻¹. However recovery time differed significantly (P < 0.05) for both treatments. The similar trend was observed with group-B Silver dollar fry when subjected to these concentrations. The recovery times for both groups of fishes observed to have increased with increase in concentrations of the clove oil (Table 1)

There was no effect of 10 and 20 mg l⁻¹ concentrations on the induction of both sized Swordtail fishes. However, these fishes remained stationary in the media indicating stage I- light

sedation as described by Durve and Raja (1965). The induction time was higher in 30 mg l⁻¹ concentration of clove oil in group- A Sword tail fishes and it was reduced as concentration increased from 30 mg l⁻¹ to

have been discussed by Pickford and Atz (1957). The use of anesthetics for fisheries experiments like transport of live fishes or handling fishes for tagging, fin clipping, weighing and stripping have been well

Table 1. Induction time and survival rate of two groups of Silver dollar fry (*Metynnis schreitmulleri* Ahl) and Swordtail fry (*Xiphophorus helleri* Heckel) treated with varying concentrations of clove oil.

Size group	Concentration (mg l ⁻¹)	Exposure Time (Sec.)	Induction Time (Sec.)	Recovery time (sec)
Group A*	10	600	0	0
	20	600	538.66±1.43	90
	30	600	357.53±0.53	165
	40	600	98.66±0.24	220
	50	600	59.46±0.35	225
	60	600	43.33±0.88	227
	70	600	39.66±0.33	230
	80	600	38.66±0.33	260
Group B**	10	600	0	0
	20	600	602.13±1.619	90
	30	600	401.86±2.4369	175
	40	600	176.53±0.3716	300
	50	600	63.33±0.133	300
	60	600	55.33±0.33	300
	70	600	52.00±1.52	310
	80	600	50.00±0.57	360
Group A*	10	600	0	0
	20	600	0	0
	30	600	413.66±0.33	150
	40	600	359.66±0.33	155
	50	600	339.00±0.57	158
	60	600	309.00±0.57	160
	70	600	289.00±0.33	162
	80	600	285.33±0.33	162
Group B**	10	600	0	0
	20	600	0	0
	30	600	599.00±0.57	95
	40	600	479.66±0.57	95
	50	600	419.66±0.33	95
	60	600	399.33±0.66	95
	70	600	385.33±0.333	97
	80	600	379.00±0.57	97

*P>0.5 (CD = 2.14); ** P>0.05 (CD = 3.59), Survival (%) is 100 %

80 mg l⁻¹. The recovery times of the group-A fishes treated with 50 and 60 mg l⁻¹ clove oil concentration was almost same (179.66 ± 0.33 and 180.00 ± 0.57 seconds). The survival rate was 100 % among all the treatments. In group-B Swordtail fishes induction time was 379.00 ± 0.57 seconds when exposed to 80 mg l⁻¹ clove oil concentrations while recovery time was 98.33±0.33 seconds (Table 1) and differed by 88.67 seconds from group-A fishes. There was no effect of clove oil on Pearl gourami probably because of their habit of gulping the atmospheric air.

Several methods have been used to induce anesthesia among the various species of fishes. (Abramowitz, 1937; Parker, 1937, 1939; Abramowitz *et al.*, 1940) like immersing fishes in crushed ice or ice water (Osborn, 1938, 1941) and electric shock to reduce the movement of fishes lasting about two minutes (Haskell, 1940). The disadvantages of such methods

recognized (Durve and Raja, 1965; Thienpont and Niemegeers, 1965; Saha *et al.*, 1965; Natarajan and Renganathan, 1960; Sreenivasan, 1962; Keene *et al.*, 1998; Munday and Wilson, 1997; Taylor and Roberts, 1999). Woody *et al.* (2002) recommended 50 mg l⁻¹ of clove oil for anaesthetizing Salmon ranging in length from 400 to 550 mm with induction time of about 3 minutes and recovery time of 10 minutes. In the present study, the induction and recovery times with 50 mg l⁻¹ of concentration was observed to be 59.46 ± 0.35, 63.33 ± 0.13, 239.40 ± 0.23 and 306.26 ± 1 for Silver dollar and 339.00 ± 0.57, 419.66 ± 0.33, 179.66 ± 0.33 and 94.66 ± 0.66 seconds for Sword tail fishes respectively. Munday and Wilson (1997) evaluated the efficacy of clove oil with other anesthetics like quinaldine, benzocaine, MS 222, 2- Phenoxyethanol and noted that clove oil was effective at much lower concentration than the other chemicals. They also stated that clove oil was

superior except the quinaldine for anaesthetizing *Pomacentrus amboinensis*, a coral reef fish as the recovery time with clove oil was 2–3 times longer than recovery from other chemicals. Woody *et al.* (2002) observed positive dependence between fish length and induction time but not with recovery time in respect of Sockeye Salmon (*Oncorhynchus nerka*). In the present study both induction and recovery times indicated positive dependence with fish length for both the fish species. The results revealed group-A fishes has less induction time compared to group-B fishes. Recovery times in group-B Silver dollar fishes was more than group-A fishes but exactly opposite results were observed in case of sword tail fishes. This indicated that the response to the anesthesia in terms of induction and recovery times might vary among the fish species. The concentration of 80 mg l⁻¹ was highly effective. The 10 and 20 mg l⁻¹ dose of clove oil could be used during transportation of Silver dollar and Sword tail fishes respectively as this dose was observed to have reduced the movement of fishes and brought them to light sedation stage. Clove oil, a natural cost effective anesthetic can become an alternative to the standard MS-222, Phenoxyethanol, Quinaldine or Benzocaine, which are hazardous, expensive and sometimes less effective (Munday and Wilson, 1997).

Acknowledgements

Authors are thankful to Dr. P.C. Raje, Associate Dean and Dr. S.G. Belsare, Senior Scientific Officer, Faculty of Fisheries, Ratnagiri for critical review of manuscript.

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