Clove oil used as an anaesthetic with juvenile tropical marine fish

Patrick Durville[1] and Adeline Collet[2]

Introduction

Clove oil has been used for a number of years to anaesthetise fish in seawater. In fish farming, this is essential for performing basic procedures such as weighing, tagging, experimental work and for transport. It considerably reduces pathology risks from stress, injury and accident during handling (Keene et al. 1998). It has also been recently proposed as a better alternative to cyanide for the capture of live reef food fish (Erdmann 1999). Clove oil is distilled from *Eugenia caryophyllata* stems, buds and leaves. In Indonesia, it has been used on humans for centuries as a local anaesthetic (Soto and Burhanuddin 1995). The active ingredients are phenol derivatives, essentially the $C_{10}H_{12}O_2$ eugenol compound (Taylor and Roberts 1999).

In a study conducted on coral fish farming on Reunion Island using wild-caught juveniles, a clove oil experiment protocol was required so as to find a means of handling fish regularly and efficiently. A series of experiments on two fish species was carried out so as initially to determine the optimum clove oil quantity for use on fish weighing less than 10 g and, subsequently, the effect of fish weight and the species under consideration.

Material and methods

The method used consisted of introducing the active ingredient of clove oil into the fish's gills through the water, ie 'anaesthesia by immersion' (Brousse 1974). The substance is absorbed through the gills and travels through the bloodstream to the central nervous system. The fish then goes through several anaesthesia stages ranging from balance loss to total motionlessness and ventilatory arrest (McFarland 1960).

In the first part of the study, clove oil from an agricultural cooperative was mixed with seawater at rates of 0.025, 0.050, 0.1 and 0.2 $ml \cdot l^{-1}$. Ethanol, which is normally used as a solvent, was not used in these experiments. The anaesthetic was simply prepared by vigorously shaking a small flask of clove oil and seawater to obtain a whitish emulsion.

The experiments were carried out on wild-caught juvenile *Valamugil cunnesius* and *Monodactylus argenteus* introduced into the farm. After a week in a tank, they were individually anaesthetised. During the experiments, each fish was placed in a two-litre treatment tank and the emulsion poured in. The 'induction time' was recorded when the fish sank motionless to the bottom with total balance loss. It was then placed in a recovery tank. During these procedures, a number of guidelines recommended by Hicks (1989) were followed:

- 24-hour diet beforehand,
- properly aerated anaesthetic bath,
- same temperature in bath as in breeding tanks, and
- thoroughly aerated recovery bath flowing through open circuit.

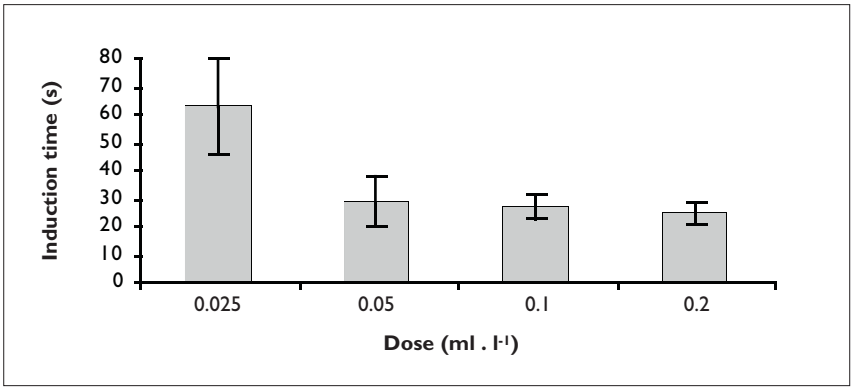
In the second part of the study, once the optimal dose had been determined for each fish type, the induction time was recorded for each specimen at the same time as its weight and species. A series of statistical correlation and mean difference tests were conducted on the data obtained.

Results

Induction times in terms of clove oil dose

A total of 100 fish were anaesthetised in four batches of 25 corresponding to the four clove oil doses: 0.025, 0.050, 0.1 and 0.2 $ml \cdot l^{-1}$. The average and standard deviation were calculated for each set (Fig. 1). A Krusskal-Wallis non-parametric test conducted on all four batches demonstrated that induction times differed significantly ($H = 55.5$; $P < 0.01$). Mann-Whitney mean difference tests were then carried out on pairs of batches, revealing significantly different induction times for 0.025 $ml \cdot l^{-1}$ doses as compared with the others. They fell by more than half from 0.025 $ml \cdot l^{-1}$ to 0.050 $ml \cdot l^{-1}$ but did not differ significantly thereafter as the dose increased. It should be pointed out that two specimens died at 0.2 $ml \cdot l^{-1}$, which may indicate the upper limit in this experiment.

1. University of Reunion Marine Ecology Laboratory, BP 7151, 15 avenue René Cassin, 97715 Saint-Denis Messag. 9, Reunion Island (patrick.durville@univ.reunion.fr)
2. Ecole Pratique des Hautes Etudes (an applied higher studies institution), ESA 8046 CNRS, University of Perpignan, 66860 Perpignan cedex, France



	0.05 ml · l^{-1}	0.1 ml · l^{-1}	0.2 ml · l^{-1}
0.025 ml · l^{-1}	**U = 606; P < 0.01**	**U = 625; P < 0.01**	**U = 625; P < 0.01**
0.05 ml · l^{-1}		U = 329; P < 0.37	U = 388; P < 0.07
0.1 ml · l^{-1}			U = 389; P < 0.06

Figure 1. Induction time averages and standard deviations observed in terms of clove oil dose, followed by Mann-Whitney mean difference test results (significant differences are in bold type).

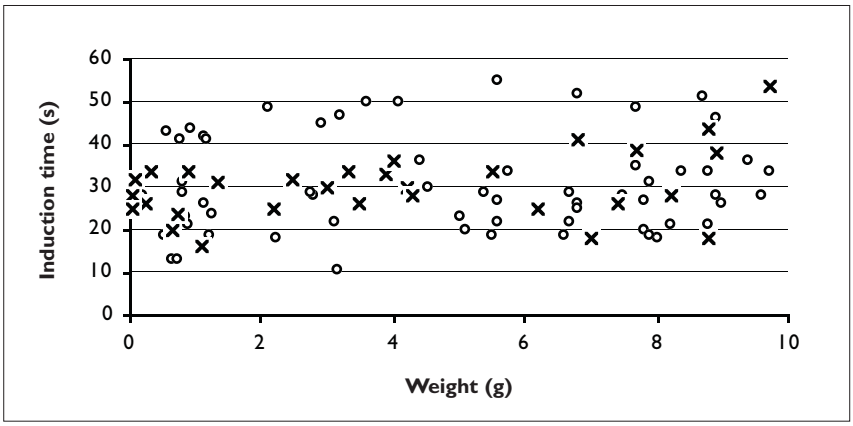


Figure 2. Induction times observed in terms of weight in *Valamugil cunnesius* (circles) and *Monodactylus argenteus* (crosses) with 0.05 ml · l^{-1} of clove oil.

A 0.050 ml · l^{-1} dose was subsequently selected for the remaining experiments. It had the advantage of anaesthetising the fish quickly with a small dose.

Induction times in terms of fish weight and species

The study on induction times in terms of fish weight was conducted using a 0.050 ml · l^{-1} dose of clove oil on 100 specimens weighing from 0.05 g to 9.7 g (Fig. 2). The induction times observed ranged from 13 to 56 seconds with an average of 30.4 ± 9.9 s. A Pearson correlation test indicated that there was no significant link between induction times and anaesthetised fish weights (Cp = 0.13; P = 0.09). The weight factor, therefore, had no effect on induction times when a 0.050 ml · l^{-1} dose was administered to fish weighing less than 10 g.

Induction times were then compared for two species, *Valamugil cunnesius* and *Monodactylus argenteus* (Fig. 2). An average of 30.1 ± 10.8 s was obtained for 67 *Valamugil cunnesius* and 30.7 ± 7.9 s for 33 *Monodactylus argenteus.* A Mann and Whitney mean difference test revealed that the difference between samples was not significant and clove oil should, therefore, have the same effect on both species (U = 1052; P = 0.23).

Conclusion

Clove oil proved to be highly effective and easy to use on juvenile tropical marine fish. The 0.05 ml · l^{-1} dose selected in this experiment anaesthetised the fish in less than a minute and made it possible to handle them without any losses. Weight did not appear to have any effect on induction times in juvenile fish (< 10 g) and clove oil could even be used on small specimens weighing less than 1 g. No induction time difference was observed between the two species considered.

These observations may also apply to other juvenile fish. Methods that suit local conditions are becoming increasingly necessary for developing tropical marine fish breeding from spawners' eggs or wild-caught post-larval and juvenile fish.

Clove oil, which is not well known or widely used, could become an alternative to the standard MS-222, Phenoxyethanol, Quinaldine or Benzocaine, which are hazardous, expensive, hard to come by in developing countries and sometimes less effective (Munday and Wilson 1997; Erdmann 1999). The results obtained may vary according to clove oil quality and active ingredient content, but this product has some potential in tropical aquaculture.

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SPC Pacific Regional Live Reef Fish Trade Initiative

Being Yeeting[1]

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Introduction

During the second quarter of 2001, several field activities were undertaken as part of SPC's Pacific Regional Live Reef Fish Trade Initiative. It was the first time that actual fieldwork was conducted since funding was approved for this initiative from the Asian Development Bank (ADB) in December 2000.

Ujae and Lae (Marshall Islands) ciguatera fish poisoning surveys

Ciguatera fish poisoning is a serious problem for many Pacific Island countries. It is a major threat to local fishing communities that depend heavily on coastal fish resources, as well as to those countries that wish to develop reef fish export trades to generate income. A better understanding of the situation and extent of the problem in the region is imperative, both for local communities and entrepeneurs.

In the Marshall Islands, ciguatera fish poisoning is a common threat to fisherfolk. Some atolls, such as Ujae and Lae Atolls, however, are uninfected or have at least insignificant incidences of poisoning.

In June 2000, due to the sudden increase of ciguatera cases on Ujae and Lae, the mayor and senators of the two atolls requested SPC to look at the problem. Between 08 and 22 March 2001, we visited the atolls and conducted a survey.

With logistical support from the Marshall Islands Marine Resources Authority (MIMRA), algae samples were collected from various sites within the atolls (20 samples from Ujae and 16 samples from Lae). These samples were processed on site and taken back for counting and analysis. Historical information on ciguatera poisoning came from interviews with local communities, and medical reports of past fish poisoning incidences came from the Health Department in Majuro.

1. Live Reef Fish Specialist, Secretariat of the Pacific Community. E-mail: beingy@spc.int