

Induction behaviour of the tilapia *Oreochromis mossambicus* Peters (Pisces: Cichlidae) subjected to electronarcosis by various alternating or rectified currents

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Abstract

Mature tilapia *Oreochromis mossambicus* were subjected to electronarcosis by alternating or rectified currents at various voltages and frequencies and in water of various temperatures and conductivities and their induction behaviour observed. Responses to induction varied from no response through slight response to vigorous response. The results support earlier findings that a 60 V, 50 Hz sine wave is superior to rectified current for electronarcosis of tilapia.

Introduction

The use of chemical anaesthetics in fish research and culture has been a routine procedure for many years. These compounds, however, are becoming increasingly expensive to use and in addition some may be hazardous to man. Electronarcosis offers a cheap and clean alternative to chemical anaesthesia and, provided certain basic precautions are taken, does not present any hazards to the operator. The suitability of both alternating and rectified current electronarcoses for use on the tilapia *Oreochromis mossambicus* has been evaluated by Barham *et al.* (1987b, 1988, 1989) who found that tilapia were suitable candidates for electronarcosis with recovery being uneventful. In some instances, however, the fish exhibited behavioural responses to the induction of electronarcosis. This study records these responses.

Materials and methods

Materials and methods used were those described by Barham *et al.* (1987a, 1988, 1989). Unless otherwise stated alternating current electronarcosis was induced with a sine wave at 50 Hz, 60 Vrms and rectified current electronarcosis was induced at 50 Hz, 200 Vp. Water temperature was 20°C and water conductivity was 430 $\mu\text{S cm}^{-1}$ for both forms of electronarcosis except when evaluating the effects of temperature or conductivity respectively. Narcosis was induced in individual fish in glass aquaria which were 60 cm long with a capacity of 45 l

Results

The initial response of tilapia to both alternating current and rectified current electronarcoses varied from a vigorous swimming movement to an immediate motionless induction. For purposes of evaluation the responses were divided into 3 categories on a purely subjective basis: no response (immediate induction), mild response (a tremor) and vigorous response before induction was achieved.

The patterns of response are reflected in Figs. 1 to 4. Alternating

current electronarcosis at 15°C by a 60 Vrms 50 Hz sine wave current and at 20°C by a 60 Vrms 100 Hz sine wave current were the only instances of alternating current narcosis to show a 100% immediate induction (no response) (Fig. 3). In contrast there were 100% vigorous responses to electronarcosis by 30 Vrms, 45 Vrms and 60 Vrms 50 Hz currents at a conductivity of 100 $\mu\text{S cm}^{-1}$ (Fig. 2). Other configurations of electrical parameters showed different combinations of responses (Figs. 1 to 3).

Instances of immediate induction in 75% of the cases included triangular, sine and square waves, all at 60 Vrms, 430 $\mu\text{S cm}^{-1}$ conductivity at 60 Vrms and a frequency of 50 Hz.

A vigorous response occurred in 100% of the fish for a square wave at 30 Vrms and also for all voltages at a conductivity of 100 $\mu\text{S cm}^{-1}$.

Of the rectified current configurations, 100% immediate induction was only achieved at 15°C while a 50 Hz pulse at 100 Vp produced a vigorous response in all fish in the group (Fig. 4).

While the current was switched on the fish remained suspended in the tank but usually sank to the bottom when the current was switched off. Occasionally a tilapia would float to the surface.

Discussion

Barham *et al.* (1988, 1989) have recommended a 60 Vrms, 50 Hz sine wave current for the induction of narcosis in tilapia. They took into account not only the narcotising ability of the above configuration, but also the fact that this configuration can be achieved relatively cheaply from the mains supply by means of an isolating transformer and a variable transformer. Although the present results indicate that a 100 Hz frequency is superior to 50 Hz, the above 50 Hz configuration, with immediate induction occurring 75% of the time and with only a small percentage of fish exhibiting a vigorous response, is a more practical configuration for electronarcosis of tilapia.

The induction responses observed in this study support the findings of Barham *et al.* (1988, 1989) that alternating current is superior to rectified current for electronarcosis of tilapia.

References

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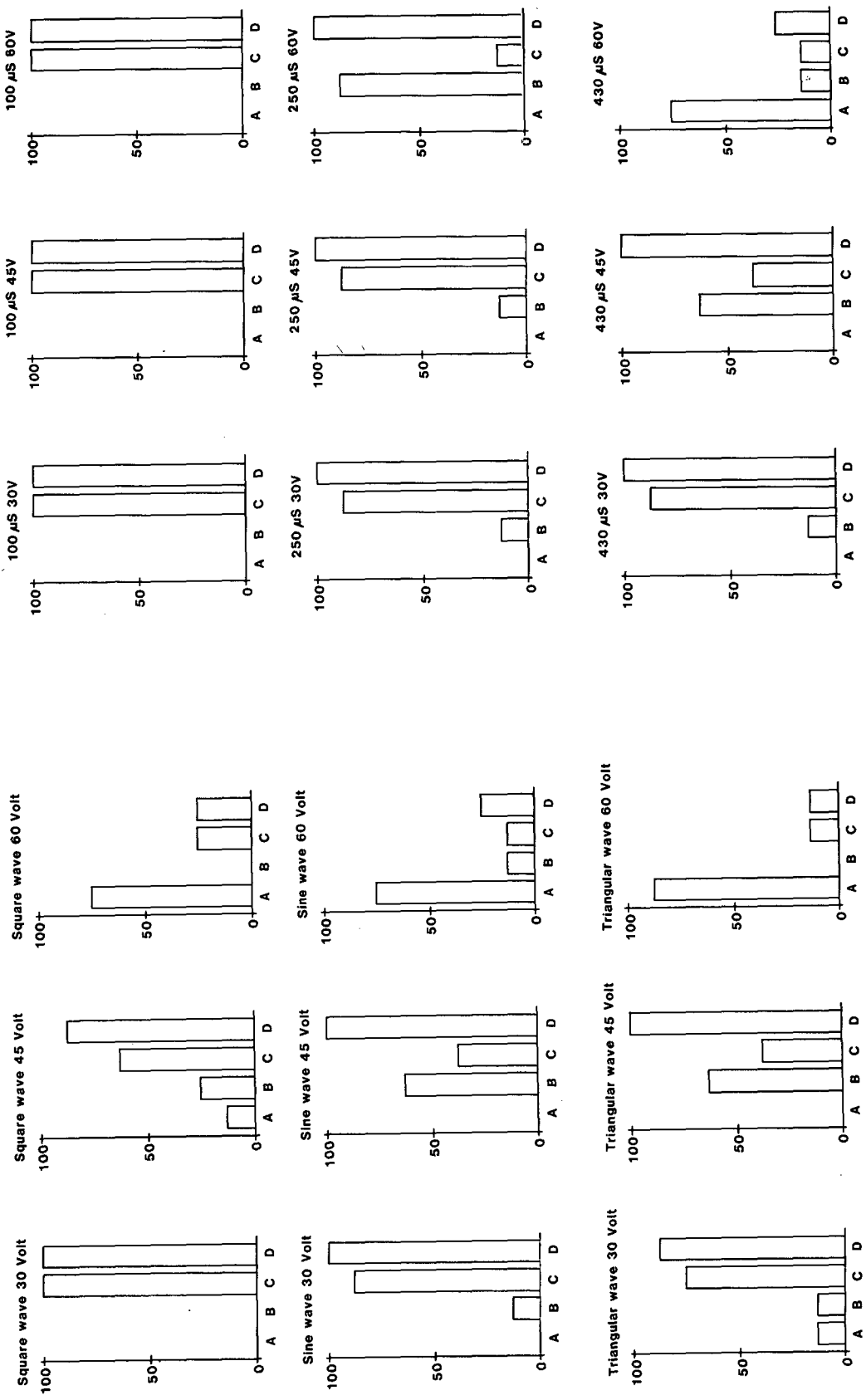


Figure 1
*A comparison of initial responses of *O. mossambicus* to electroanarcosis by alternating current wave forms. A = Immediate induction; B = Mild response; C = Vigorous response; D = Total B + C.*

Figure 2
*A comparison of initial responses of *O. mossambicus* to alternating current electroanarcosis at different potentials and in water of different conductivities (categories the same as in Fig. 1.).*

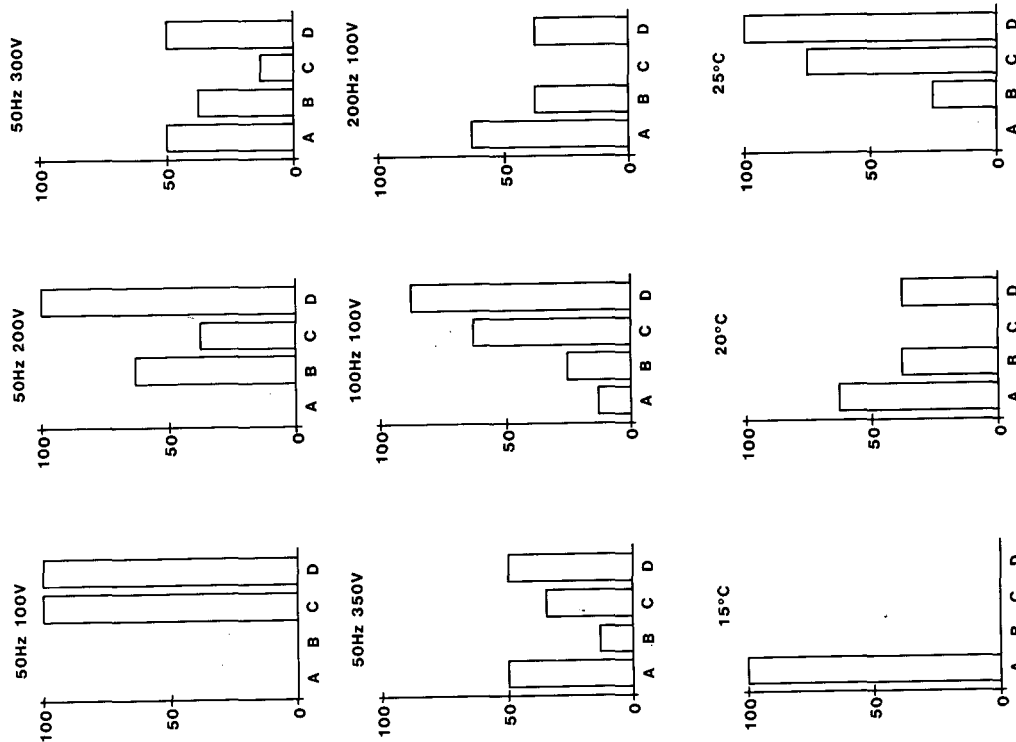


Figure 4
*A comparison of initial responses of *O. mossambicus* to half-wave rectified current electrocution at different frequencies and potentials and at different water temperatures (categories the same as in Fig. 1).*

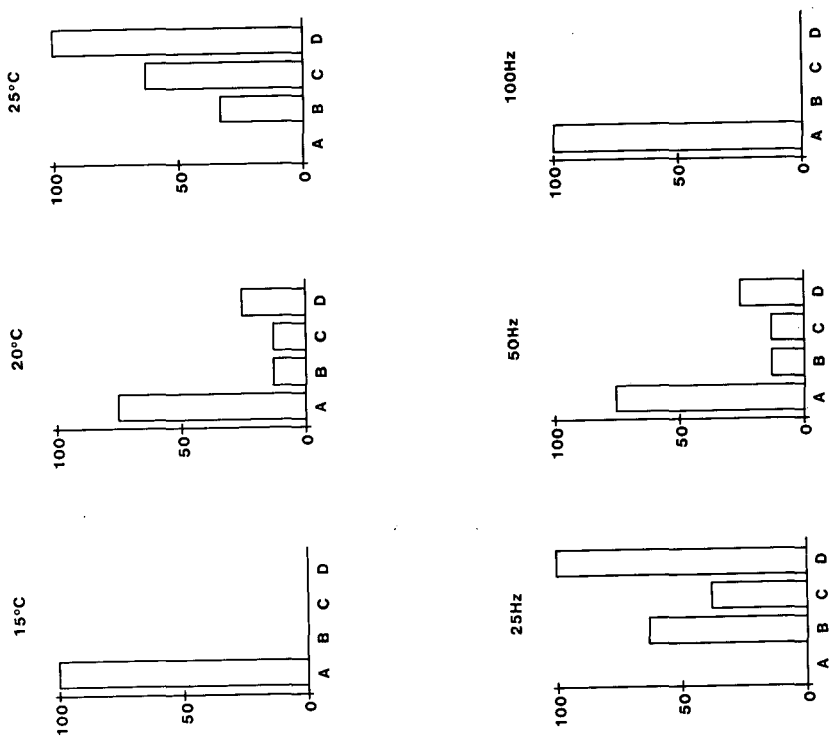


Figure 3
*A comparison of initial responses of *O. mossambicus* to alternating current electrocution at different water temperatures and at different frequencies (categories the same as in Fig. 1).*

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