Anesthetic Efficacy of Clove oil, Benzocaine and MS-222 under Simulated Long Transportation Conditions of Koi (*Cyprinus carpio* L.)

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Koi (Cyprinus carpio) is one of the most popular temperate ornamental fish species. Growth of the Koi trade in Sri Lanka is hindered by poor packing strategies and mortalities during transport. Therefore, the study aimed at evaluating the anesthetic efficacy of Clove oil, Benzocaine, and MS-222 in simulated long transportation conditions on Koi. 75 d old Koi with standard length (6.025 ± 0.04 cm) and weight (6.153 ± 0.23 g) were selected for the experiments. These individuals were subjected to four different dosages of anesthetics, based on the results obtained at the range-finding test. Each sample consists of 10 individuals and dosages were triplicated. Samples were exposed to simulated transportation conditions for 10, 20, 30, 40 h, and effective dose for each anesthetic was determined by assessing the Sedation Induction Time (SIT), Recovery Achievement Time (RAT), Mortality Rate and Post-exposure Survival Rate of Koi. Changes in water quality parameters including pH, ammoniacal nitrogen, and dissolved oxygen in transport water were recorded. Results obtained were analyzed using one-way ANOVA followed by Tukey's' method and General MANOVA using Minitab 17.0 version ($p< 0.05$). Among four different test concentrations used for clove oil, 145 μLL^{-1} was recorded as the best concentration while 140 μLL^{-1} and 70 mgL^{-1}were obtained for Benzocaine and MS-222 respectively, based on the results obtained from statistical analysis of SIT and RAT ($p<0.05$). Further, there were 0% mortalities for the 40 h test period and 7 d after recovery for all the three anesthetics at effective concentrations ($p<0.05$). In conclusion, the present study indicates that all three anesthetics perform well in the above concentrations. However, clove oil can be used as a good substitute for synthetic anesthetics because of its efficacy at a lower dosage with higher safety at a low cost.

Keywords: Sedation, Ornamental carp, Ornamental fish trade, Mortality rate, Packing density