EFFECT OF ILLUMINANCE AND WHITE LIGHT SPECTRUM ON GROWTH PERFORMANCE IN NOBLE CRAYFISH (*ASTACUS ASTACUS* L.)

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Introduction

There is an increasing interest for the intensive production of noble crayfish in Europe. Unfortunately, these decapods are highly cannibalistic, hindering the development of commercially viable intensive production (Abeel et al, 2014). In recent years, progress has been made regarding the optimization of noble crayfish culture in RAS. However, information on the illumination requirements for this species remains scarce. Light conditions such as illuminance and light spectrum are known to affect growth in crayfish (d'Agaro et al., 2008). In this study, we evaluated the effect of white light spectrum and illuminance of fluorescent lights on noble crayfish growth in RAS.

Materials and methods

468 pond raised noble crayfish (*Astacus astacus* L.) summerlings were obtained from a German farm and stocked in an indoor RAS. The crayfish were divided over 18 tanks, resulting in a stocking density of 52 individuals.m^{-2}. Initial body weight was 0.66±0.13g (mean ± SD). PVC pipes were provided as shelters. Water temperature was 21.0±0.4°C. The animals were reared under six different light conditions during 191 days.
In order to provide three spectrums of white light, three types of 36W T8 fluorescent lights were used: cool, neutral and warm, with correlated colour temperature (CCT) ≈ 5500K, 3800K and 2600K respectively. For each of these spectrums, two light intensities were tested: bright light (761 lux) and weak light (38 lux). This way, we obtained six different light conditions, as shown in table I. Three tanks housing 26 crayfish each, were used per treatment.

Table I. Six experimental light conditions, used in the RAS

Light condition	Lamp type	Cover	Intensity	Spectrum
cool bright light	Philips T8 36W 865	no	761 lux	CCT ≈ 5500 K
neutral bright light	Philips T8 36W 840	no	761 lux	CCT ≈ 3800 K
warm bright light	Philips T8 36W 827	no	761 lux	CCT ≈ 2600 K
cool weak light	Philips T8 36W 865	yes	38 lux	CCT ≈ 5500 K
neutral weak light	Philips T8 36W 840	yes	38 lux	CCT ≈ 3800 K
warm weak light	Philips T8 36W 827	yes	38 lux	CCT ≈ 2600 K

Every four weeks, growth was determined by weighing the crayfish and by measuring the occipital carapace length (OCL) with a digital caliper. Animals were counted in order to calculate the survival rates for each tank.
We used non-parametric tests to statistically analyse growth and survival data. A Kruskal Wallis test was performed to see if there was a difference in weight gain, OCL increment and survival between the 6 treatments. The effect of illuminance on weight gain and OCL increment was tested separately with a Mann-Whitney test.

Results

Average weight gain after the experimental period was 0.900±0.112g (mean ± SD). Weight gain per treatment is illustrated in figure 1. No significant differences were found among the six treatments (p=0.183). To evaluate the effect of light intensity, we combined growth data from treatments with the same illuminance. Comparing the results from the 38 lux to 761 lux treatments, we found that crayfish cultured under weak light (WL) showed a significantly higher weight gain than those kept under bright light (BL) (p=0.040). Crayfish from the WL treatments showed an average weight gain of 0.954±0.129g, while animals from BL treatments grew only 0.846±0.061g (fig. 1b).

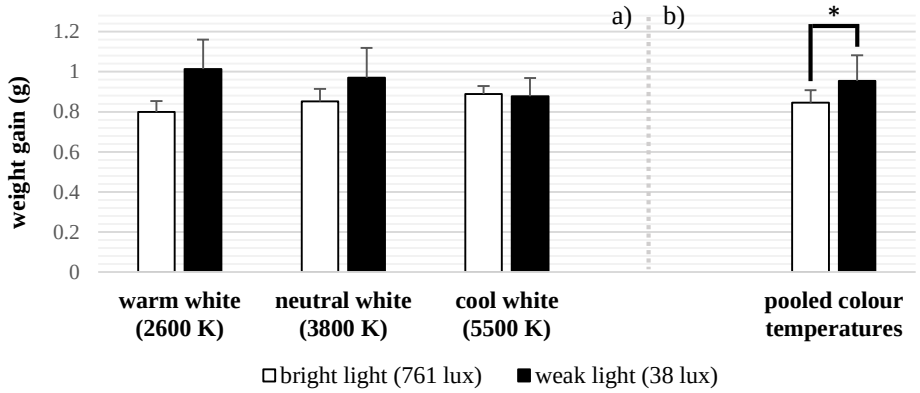

Fig. 1. Average weight gain per treatment. Asterisk (*) indicates statistical significance. a) Weight gain for each correlated colour temperature (CCT) and light intensity. b) Pooled data from all colour temperatures: 2600K, 3800K and 5500K.

In WL treatments, final occipital carapace length (OCL) also tended to be higher (p=0.050). Average OCL increment was 3.498±0.383 mm for WL and 3.182±0.186 mm for BL. The spectrum had no effect on weight gain (p=0.998) or OCL (p=0.671). Average survival rate was 94.87±4.17%. The light conditions did not affect survival (p=0.865).

Discussion and conclusion

Both weight gain and OCL increment indicate light intensity is a determining factor for noble crayfish growth in recirculating aquaculture systems. Different spectrums of white light did not affect growth. In this study, animals reared under 38 lux showed higher growth rates than those reared under 761 lux. Other light intensities between 0 and 760 lux should be tested, in order to determine the optimal illuminance for *A. astacus* culture. Applying low light intensities in intensive noble crayfish culture should lead to faster growth and can minimize electricity costs as well. Optimizing this parameter may therefore improve cost efficiency and economic viability in crayfish aquaculture.

References

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