Evaluation of Different Regimes for Seabream (*Sparus aurata*) Larval Rearing

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ABSTRACT: This study was conducted to evaluate the effect of the partial and total substitution of live algae in a green water system with stain in seabream (*Sparus aurata*) larval rearing, three treatments were applied green water treatment (algae treatment), 50% algae and 50% stain treatment (mixed treatment) and 100% stain treatment (stain treatment). Water quality, body length, survival rate, percentage of deformity were measured, and the results revealed that higher dissolved oxygen were maintained at mixed treatment (5.14ppm), no significant differences in total length between all treatments, the final body weight at day 120 of big size group was higher in mixed treatments (0.26 gram) in the end of experiment. mixed treatment had the highest number of big size group (15%) and the lowest number of small size group (43%), survival rate at day 60 was highest in the algae treatment (22.77 %) followed by mixed treatment (22.76 %) with no significant differences, survival rate from day 60 till day 120 after hatch was higher in mixed treatment (50.20%) than algae treatment (49.6%), the incidence of deformities was low at all treatments. It could be concluded that the stain could substitute live algae with good results.

Keywords*: Seabream, Live algae, Stain, green water system, survival rate, deformity percentage*

INTRODUCTION

Global aquaculture participates with about 46.0 percent of the world fish production in 2021 (FAO, 2022), from 25.7 percent in 2000. After 2011 revolution, several national projects have been built in different regions of Egypt. The most important of these projects were aquaculture mega projects as Gholion, Shark El Tafriaa and Suez Canal region Projects that aims to increase marine aquaculture productivity, provide good sources of fish protein, increases food safety in terms of quality and quantity, reduces the aquaculture products import and increase export which led to improvement of the national income and to an increase of Egyptian currency value and demand. Recently, large governmental mariculture projects were established in Kafr El sheikh (Gholion) which have its own hatcheries, East Port Said (Shark El Tafriaa Project in port said governorate) and the Suez Canal region (mariculture project in Ismailia governorate), all of these projects require large quantities of high quality and healthy fish and shrimp larvae. These projects depended on larvae imported from Italy, Greece, Saudi Arabia and other places leads to unstable and unsustainability of seeds supply and unpredictability of production and leads to unsuccessful sector planning and slows aquaculture sector development. There is a great demand for locally produced marine fin fish and shrimp larvae. Egyptian marine hatcheries either private sector and governor sector are unable to meet the larvae requirements of national projects and private sector needs because of its relatively low productivity, quality and seasonality of production.

Gilthead seabream, *Sparus aurata* is public throughout the Mediterranean region and considered as one of the most popular species for food. It is a target for intensive farming. It also has been cultured widely in many countries including Egypt. Seabream breeding season is in the wintertime in the natural environment but in aquaculture it can be driven to spawn all year round under artificially controlled environment (Morretti, 1999).

Larval rearing of sea bream can be taking place by using many rearing methods ranging from extensive (low density) to intensive (high density) in the presence (green water systems) or absence (clear water systems) of live algae. In the last decade, several enhancements in the quality of live food offered to the larvae (Lavens et al., 1995) and the rearing methods (Divanach et al., 1998) have been made and employed in the rearing period. Although all larval rearing processes that resulted in high larval quality contained the use of microalgae, the reasons for this are still uncertain. Microalgae appears to play a key role during the rearing of the early stages of many marine species (Divanach et al., 1998; Oie et al., 1997; Holmejford et al., 1993). Several hypotheses have been discussed to explain the role of live algae in green water systems in preserve and improving the rearing culture environment (Van der Meeren, 1991; Reitan et al., 1993) or indirect nutritional effect (Tamaru et al., 1993). The frequent adding of phytoplankton in larval rearing systems have good effect on the microbiology, nutrition value, feeding rate, and behavior of the larvae (Howell, 1979; Naas et al., 1992; Nicolas et al., 1989; Palmer et al., 2007; Reitan et al., 1993; Utne-Palm, 2004). The successful production of high-quality seabream larvae still needs a green water step in the early larval-rearing period, microalgae have been shown to supply a direct nutritional input to many species as they can ingest (intentionally and unintentionally) the microalgal cells at the first feeding time (Vasquez-Yeomans et al., 1990; Palmer et al., 2007). Algae can also improve the nutritional quality for the live prey that is supplied into the culture tank, as long as live feed retention time in the culture tank was high (Reitan et al., 1993; Tamaru et al., 1994). Finally, enhanced larval feeding has been attributed to the improved vision in turbid waters as turbidity increase the contrast between the prey and the tank color (Miner and Stein, 1993; Naas et al., 1992). All the previous

benefits made finding suitable and valid alternatives a complicated issue.

However, the amount of phytoplankton needed to produce 1 million seabream fry is about 40,000 liters using microalgae produced in the traditional batch cultures methods at an average cell density of 19.106 cells/ml or 5,000 liters using microalgae produced in intensive methods such as photo-bioreactors at an average cell density of 180.106 cells/ml (Divanach et al., 1998). The high popular and most used microalgae are Nannochloropsis, Chlorella and Isochrysis species. All these microalgae have been characterized with the presence of high concentrations of the highly unsaturated fatty acids, vitamins and/or proteins, or antibacterial properties that make them highly necessary for the larval rearing phase of seabream fish and many other marine finfish species. (Vasquez-Yeomans et al., 1990; Palmer et al., 2007).

The aim of the present study is to evaluate the influence of the partial and full substitution of phytoplankton by synthetic food stains on the Water quality, body length, survival rate and deformity rate of sea bream larvae reared under intensive conditions.

MATERIALS AND METHODS

This experiment was performed at Harraz marine hatchery located at Nemra 2, Al-Qantarah Gharb,52 Suez Canal Road, Ismailia, Egypt. Brood stock unit, egg collection and feeding management. Brood stock of seabream was kept at 6 diameter concrete tanks with water depth of 1.2 m with a total volume of 28.26 m^3. The tanks were painted in black color, have seawater inlet pipe of 2 inch and have a 1.5-inch pipe for chilled water supply for temperature control. Brood stock unit was equipped with fully automated system for water temperature control and light photoperiod with dimmer effect. The unit contains 100 females (weight of 1.5:3kg average (2.25 kg)) and 50 males (weight of 0.25:0.4kg (0,325 kg)). Breeders were stimulated to bred by controlling temperature and photo period to have natural breeding (Lavens and Sorgeloos, 1996). Eggs were collected by surface egg collector made by 4-inch PVC pipe with extended arm to tank center and with depth of 5 cm on water surface. eggs are automatically collected by egg collector which was 500 liters' circular fiberglass tank equipped with 500-micron mesh size net which allow to retain eggs and allow water to flow through. The overflow collector is placed outside the spawning tank below surface level and a blade guides floating eggs on surface into overflow collector which improve collection mechanism and collect eggs in minimum time. Then eggs are collected by fine screen scope net then disinfected and counted volumetrically (Moretti et al., 1999). water level inside the collector tank is maintained by overflow outlet in a way that it is only few centimeters below the level in the spawning tank which allow egg collection with very high quality and minimum handling effect. Eggs retained by the screen were kept floating by water flow and a gentle aeration. Eggs were collected at early morning to avoid handling eggs at late development stages (Palmer et al., 2007).

Breeders were fed on live foods like squid, shrimps, and sardine once per day in afternoon six days per week.

Larval rearing:

Larval rearing unit consists of 20 cylindrical conical fiber glass tanks located at fully isolated greenhouse. Each cylindrical conical fiber glass tank is epoxy painted in light gray with internal diameter of 3 meters, depth of 1.5 m (1.2 m water column) and 2% bottom slope (volume of 8.5 cubic meter). Each tank is equipped by 2 surface skimmers to remove oils and any floating debris from water surface. These surface skimmers are regularly cleaned by scrapping by paper tissue throughout the day. In order to control water quality parameters each tank was equipped with 4" central drainpipe ,1.5 " overflow drain, 0.5 " air pipe diffused to 5 fine air stones ,1"seawater supply ,1"chilled water and double florescent bulbs of 40 watts and placed "80 cm above water surface (Utne-Palm, 2004).

Nursery unit consists of concrete tanks epoxy coated in light gray located in semitransparent greenhouse. Each tank has sea water inlet of 1.5"and 4" drainpipe.1,5 m water depth and four 0 .5 " air pipe.

Algal production:

Algae production consist of indoor production unit of pure strain seeds "Nannochloropsissp, Chlorellasp, and Tetraselmissp. Which used only for rotifer culture". Pure seeds of algal starter are up scaled from test tube till 18-liter carboy container then transferred to outdoor mass culture in outdoor production unit which start up scaling from 400-liter cylindrical conical fiber glass tanks then 1 cubic meter plastic tanks then 5 cubic meter U-shape fiber glass tanks (Moretti et al., 1999).

Rotifer culture:

Rotifer production consists of indoor production unit of pure strain seeds of rotifer Brachionus plicatilis and mass culture in outdoor production unit which start scaling up from 400l cylindrical conical fiber glass tanks then 3.5 cubic meter u-shape fiber glass tanks. Enrichment of rotifer DHA protein Selco take place in 400l cylindrical conical fiber glass tanks. (DHA Protein Selco, INVE) was used according to the specifications of the provider (Palmer et al., 2007).

Pure strain rotifer seeds are taken from pure strain unit after matching all selection criteria like fecundity, viability and absent of bacterial loads.

This seeds are then upscaled using only algae to rich 400 liters with density of 300-400 per ml, then harvested, washed and used to inoculate a full group. This procedure ensures high rotifer quality, quantity and less chances of culture fails. Rotifer are inoculated at 200 individuals per ml in 25%of tank volume filled with algae at log stage then fed 4 times per 24 hours with 0,3-0,5-gram yeast per million rotifers. Each day 25%of tank is filled with algae to reach full tank capacity at day 4.at each day one group of four groups is harvested counted and transferred to enrichment tanks for 12-24 hours' enrichment by DHA Protein Selco, INVE according to the specifications of the provider. Then harvested, washed and counted then fed to larvae (Naas et al., 1992).

Artemia production:

Artemia production consist of one tank cylindro-conical fiber glass tank with volume of 50 liter used for decapsulation,10 cylindrical conical plastic tanks of 500 liters for incubation and 3 cylindrical conical fiber glass tanks of 1.5 cubic meter for enrichment by DHA Protein Selco.(DHA Protein Selco, INVE)was used according to the specifications of the provider. All are suited in semi-transparent greenhouse (Lavens et al., 1995). After weight needed quantity of artemia cysts according to feeding schedules, cysts hydrates at 3 times volume of fresh water for one hour then collected to start decapsulation process, all materials needed for decapsulation must be prepared before any action is taken, like sodium hypochlorite, sodium thiosulfate, harvest equipment prepared and ready for use. Decapsulation process take about 10:15 minutes according to sodium hypochlorite concentration. Each 1g of cyst needs 0.5 g of active chlorine and 0.15 g of sodium thiosulfate to neutralize residual chlorine. Ice is needed to control temperature not to exceed 30° C because oxidation process reject heat. After decapsulation was done decapsulated cyst were incubated in incubation tanks or be socked at brine solution and kept in refrigerator for further use. Decapsulated cyst are incubated in incubation tanks at 1-2 gram per liter at 25 ppt salinity at 25 -27 degree Celsius for 24 hours to obtain maximum hatching rate, newly hatched *Artemia nuaplii* is then harvested and transferred to enrichment tank for enrichment procedure for 12 or 24 hours by Protein or DHA Protein Selco® according to instructors of the supplier (INVE company) (Moretti et al., 1999).

Experimental design:

The experiment was performed in triplicates (3tanks for each treatment) Control treatment (the pseudo green water uses only live algae (noted as GW T1), the first treatment (mix use of algae 50% and stain 50% (noted as mixed T2) and the second treatment (only use of stain100% (noted as stain T3). The experiment lasted for 120 days. Each tank was stocked by 600000 eggs, disinfected by iodine dipping for 3 minutes. After 48 hours at 19 ^{o}c hatching occurs. After hatching, spawning tank was siphoned to clean tank bottom. At day four after hatching experiment was beginning by adding algae to GW tanks, mix of algae and stain was added to mix tanks and only stain was added to stain tanks. The experiment was performed in three treatments with triplicates (3 tanks for each treatment). Control treatment (the pseudo green water uses only live algae "noted as green water GW" T1), the first treatment (mix use of algae 50% and stain 50%" noted as mixed" T2) and the second treatment (only use of stain 100% "noted as stain " T3). The pseudo green water technique was realized following the method described by Papandroulakis et al. (2001). This technique is based on the frequent addition of phytoplankton and zooplankton to the larval rearing tanks. Green water technique was developed in order to improve survival and growth rate of post hatched gilthead seabream (*Sparus aurata*) larvae intensively produced (Dimitrios et al., 2010). In green water treatment 100% of green water effect was obtained by using live algae only (*Nannochloropsis oculata* and *Chlorella* sp) (T1). In mixed treatment 50 % of green water effect was obtained by using live algae and the other 50% was obtained by using stain(T2). stain treatment 100% of green water effect was obtained by adding stain only(T3). Algae and stain were added three times daily to obtain required effect.

Stain preparation:

Stain stock solution is prepared by adding 300 g of Kamena aromatics colors R (150 g of green color stain and 150 g of brown color "dark brown 315 25% "stain) into 10 L salt water and mixed for 5 minutes.

Stain compositions:

According to Kamena aromatics colors R company located at Giza – Egypt, this stain contains tartazien and other ingredient which code number are (E102), (E110), (E122) and (E133). And have agreement from Egyptian ministry of health as a food coloring agent.

Stain addition procedure:

Daily amount of stain for stain only tanks 300 ml from prepared stock solution and for mixed stain tanks 150 ml. Stain addition is divided into 3 times per day. For only stain tanks "3 tanks "900 ml is taken from stain stock solution and add in 10-liter bucket then filled till 3 liters of salt water then distributed equally to 3 tanks during the day. for mixed stain tanks "3 tanks "450 ml is taken from stain stock solution and add in 10-liter bucket then filled till 3 liters of salt water then distributed equally to 3 tanks during the day combined by adding live algae 150 liter per day. For control tanks algae no stain is added only 300 liter of mature algae is add to each tank "3 tanks "during the day. Features of stain usage :Easy and fast application, control of tank color, reduce chances of introduction of contaminates, reduce stress and unwanted larval aggregation, reduce cannibalism, reduce fluctuates of environmental parameters especially sudden change of water temperature, give excellent water contrast that mimics live algae, increase the ability of larvae to detect their prey because it stain rotifers with green color which make it easy for larvae to see rotifers and eat them, reduce production cost ,reduce labor cost and allow for extra water exchange.

Larvae feeding protocol:

Prey size at first feeding is of high importance for gilthead seabream larvae. Because of their very small mouth, during the very first days they can only ingest preys smaller than 100 µm. Rotifers were fed from day 4 by small-size- strain rotifers (50-100 µm juvenile and adult respectively) then switch over large strain rotifers (150-250 µm). Prey density at this stage should be kept at 5 to 10 rotifers/ml (Lavens et al., 1995), to maintain these density rotifers are fed 3 time per day. Artemia were fed at day 30 by using AF artemia^{R} for 5 days then newly hatched EG artemia for 5 days then 24 hours enriched EG artemia^{R}. Artemia density is kept at density of 0.5-2 nuaplii /ml by adding 3 meals per day. Rotifer and artemia were combined till day 40 post hatch. The daily ration of live feeds was distributed in 3 meals per

day (40% at 07.00 am,30% at 13.00 pm and 30% at 19.00 pm). Dry feeds (80-300 microns) were fed in increased ratio from day 40 till fully weaned larvae at day 60 post hatching. Dry feeds are fed 6-8 times per day. Dry feed size was gradually increased from 80-200 µm size till 150-300 µm size during larval rearing stage till day 60 post hatching. Larval feeding sequence for the different treatments mentioned in Figure (1).

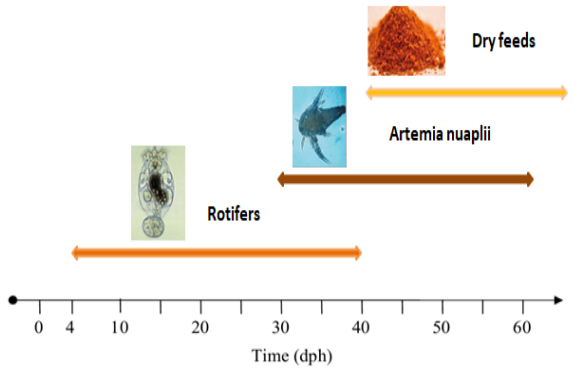

Figure 1: Larval feeding sequence for the different treatments

Target traits:

Total length was measured at 60- and 120-day post hatching (dph), Survival rate also measured at 60 and 120 dph according to the formula: survival rate = (Number of fish at the end of the study /Number of fish initially stocked) *100, swim bladder deformity and skeletal deformity were measured at the end of the experiment according to Sokal and Rohlf (1981). Weight gain (WG) = Wt – Wo, where Wt = final weight, Wo = initial weight. Feed conversion ratio (FCR) = Feed intake /(Weight gain).Average daily weight gain (ADWG) =final weight –initial weight \days. Sokal and Rohlf (1981). Different size groups were sized by using 1,2,3,4 mm graders. Water Salinity was measured by refractometer ATCR, temperature and dissolved oxygen were measured by (HANNA porTable DO meter), pH levels were recorded with (HANNA Microprocessor pH meter).

Statistical analysis:

Data were analyzed using SPSS version 22. (2014) One-way ANOVA in SPSS were used to analyze the data of growth performance and feed utilization. Duncan's test was used to determine the significances of differences between treatments. The significance was tested at 0.05 levels.

RESULTS and DISCUSSIONS

Water quality parameters:

Water quality in sea bream larval rearing tanks treated with green water, Mixed green water and stain and stain for 60 days post hatch is showed in Table (1). The highest dissolved oxygen at 60 days after hatching was recorded in T2 with (5.14ppm) followed by T1 (5.12ppm) while; the lowest dissolved oxygen was recorded in T3 (5.10a ppm) treatment.

Table 1: Water quality in sea bream larval rearing tanks treated with green water, Mixed green water and stain and stain for 60 days post hatch.

	DO ppm	PH
T 1 GW	5.12 ±.00	7.40 ± .00
T 2 mixed	5.14 ± .00	7.41 ±.00
T 3 stain	5.10 ± .00	7.40 ±.00

There were no significant differences ($p<0.05$) among all treatments, as shown in Table (1). The highest pH at 60 days after hatching was recorded in T2 with (7.4132) followed by T1 (7.4001) and the lowest pH was recorded at T3 (7.4000) treatment. There were no significant differences between all treatments. Adding different species of algae to seabream larval rearing units have several advantages on water quality improvement (Hernandez-Cruz et al., 1994; Liao et al., 2001; Papandroulakis et al., 2001; Faulk and Holt, 2005). The most recent hypothesis for the better performance of marine finfish larvae produced under controlled conditions on green-water systems are that microalgae have a lot of effects on water quality and larvae itself, provide a direct and indirect nutritional value for larvae, act as chemical and digestive stimulants, enhance the non-specific immune system, enhance environmental conditions for feeding from increased turbidity, light scattering and visual light contrast enhancement for larvae, enhance water quality due to reducing of nitrogenous substances and increased oxygen rates, possess antimicrobial and antiviral properties and possess detoxifying properties (Palmer et al., 2007; Makridis et al., 2009).

Total length:

Total length of seabream larvae treated with green water, mixed green water and stain for 60 days' post hatch was showed at Table (2).

Table 2: Total length of sea bream larvae treated with green water, Mixed green water and stain and stain for 60 days post hatch (dph)

	Length at 60 dph (cm)
T 1 GW	1.91 ± 0.04
T 2 mixed	1.80 ± 0.06
T 3 stain	1.79 ± 0.03

Larvae showed an exponential growth rate in all treatments tested during larval rearing stage. The total length at 60 days after hatching was slightly higher in T1 (1.91 cm) but was not significantly different ($p>0.05$) than T2 (1.80 cm) and T3 (1.79 cm) treatments. As shown in Table (2). Cobcroft et al. (2012) showed that, striped trumpeter was cultured from first feeding to 29 days post-hatching (dph) in different coloured tanks (black or white), culture conditions (clear water or green water system) and fed different live foods (enriched or non-enriched rotifers and Artemia). The study revealed that the use of green water, black tanks and enriched live feeds is required for good growth, development, survival and final yield of striped trumpeter.

Final weight at day 120 dph:

Final weight of seabream larvae treated with green water, Mixed green water, and stain for 120 days post hatch was showed at Table (3).

Table 3: Final weight of sea bream larvae treated with GW, Mixed and stain for 120 days' post hatch.

Treatment	Final weight group1 (g)	Final weight group2 (g)	Final weight group3 (g)
T 1 GW	0.23c ±.00	0.189c ± .00	0.150a ± .00
T 2 mixed	0.26a± .00	0.190b ±.00	0.140b ± .00
T 3 stain	0.24b± .00	0.199a ±.00	0.131c ± .00

-values in the same column with different superscripts are significantly different. (Significance at 0.05).

Final weight of group 1 (big-size group) was higher in T2 with (0.260 g) followed by T1 (0.230 g), while the lowest final weight values were recorded in T3 (0.241g), with a significant difference ($p<0.05$) in the final weight among the three treatments. Final weight of group 2 (medium-size group) was higher in T3 with (0.199 g) followed by T2(0.190 g), while the lowest final weight values were recorded in T1(0.189g), with a significant difference ($p<0.05$) in the final weight among the three treatments. Final weight of group 3 (small-size group) was higher in T1 with (0.150 g) followed by T2 (0.140 g), while the lowest final weight values were recorded in T3 (0.131 g), with a significant difference ($p<0.05$) in the final weight among the three treatments. As shown in Table (3). Papandroulakis et al. (2002) showed that relative growth rate in terms of total length was very small (about 1%) for all groups until the total absorption of the oil droplet, the relative growth rate in wet weight in the presence of phytoplankton was twice that showed in the absence of it. During this period, larvae consume energy from exogenous feeding and the oil droplet reserves in order to meet their requirements (Guyot et al., 1993). As reported by Divanach and Kentouri (1983), the time for the complete absorption of the oil droplet by sea bream larvae is dependent on exogenous food quality.

that the correlation analysis gave a different picture of the role of the number of fruits per plant, branches and fruit diameter in the fruit yield than that provided by the path coefficient analysis. Therefore, indirect selection through other constituent traits with these traits showing positive indirect effects can be recommended so as to cause improvement in yield. It can be seen that most of the direct effects were below the phenotypic level in L2 indicating that hypertrophy due to poly linearity was minimal phenotypically. In all, the studied traits accounted for 100.75 and 91.93% of the fruit yield/plant diversity in Dumah Al-Jandal (L1) and Rafha (L2) sites, respectively. The remaining content (-0.75 and 8.07%) could be attributed to unknown factors (random error) and/or some other trait that was not included in the current study.

Previous reports have provided evidence that the number of fruits or plants has a direct, favorable impact on yield/plant (Rani et al., 2008, Islam et al., 2010). The outcome was in line with Saleem *et al*. (2013) findings. In contrast to Ghosh *et al*. (2010) who observed a direct negative influence of plant height on yield/plant in

The highest survival rate at 60 days after hatching from a total of 600,000 eggs initially incubated directly in larval rearing tanks was recorded in T1 with (22.77 %) with no significant difference ($P>0.05$) from T2 (22.76 %), but T1&T2 were significantly different ($p<0.05$) from T3 (17.9 %), which was the lowest survival recorded. As shown in Table (4).

Survival rate:

Survival rate was measured at day 60 and 120 post hatching.

Table 4: survival of sea bream larvae treated with green water, Mixed green water and stain and stain for 60 and 120days post hatch.

	Survival at 60 dph %	Survival 60:120%
T1 GW	22.77a ± 0.00	49.6b±.00
T2 mixed	22.76a ± 0.00	50.2a±.00
T3 stain	17.90b ± 0.00	40.4c±.00

values in the same column with different superscripts are significantly different. (significance at 0.05)

The highest survival rate in green water system also reported by Stuart and Drawbridge (2011) who found that the highest survival rate (9.2±3.1%) was observed in the green water system, high light intensity treatment. While the lowest survival rate (0–0.10%) was obtained in the low and medium light intensity, clear water groups had. The highest survival rate at the period of 60 to 120 days after hatching was recorded in T2 was (50.2 %) followed by T1 (49.6 %) and the lowest survival was recorded at T3 (40.4%) treatment. the final survival at the period of 60 till120 days after hatching were Significantly different ($p<0.05$) among the three treatments. As shown in Table(4). Papandroulakis et al. (2002) Sea bream larvae were reared under intensive conditions either with pseudo-green water technique or without (clear water technique). the frequent adding of phytoplankton in the rearing tanks, under 24- or 18-h photo phases. Phytoplankton presence in the rearing culture medium resulted in 44±17% survival and individuals of 2.0±0.2 mg wet weight after 20 days of rearing. in clear water method, both survival and growth decreased to 16±6% and 1.1±0.2 mg, respectively. During early time of larval stages, the rate of mortality was 2–3 times higher than groups reared with clear water technique than the ones reared with the pseudo-green technique, a difference maybe because of absence of phytoplankton in the previous method (Oie et al., 199). Cobcroft et al. (2012) survival rate of seabream was almost twice as high in green water (46±18%) than clearwater (26±13%).

Table 5: Percentage of different size groups of sea bream larvae treated with GW, Mixed and stain for 120 days post hatch:

Treatment	Percentage of group1 %	Percentage of group2 %	Percentage of group3 %
T1 GW	10.3b ±0.000001751	37.0b± 0.000178569	46.5a± 0.000006810
T2 mixed	15.2a ± 0.000002063	41.0a±0.000007136	42.9a± 0.000005410
T3 stain	10.8b ± 0.000002275	42.8a±0.000010061	44.8a± 0.000011308

-values in the same column with different superscripts are significantly different. (Significance at 0.05).

Percentage % of different size groups: Percentage of different size groups of seabream fries treated with green water, Mixed green water and stain and stain for 120 days post hatch was showed at Table (5).Percentage of big-size group fries was higher in T2 (15 %) followed by T3(10 %), while the lowest Percentage were recorded in T1(10 %), T2 was Significantly different ($p<0.05$) in the Percentage of big-size group fries from T3 and T1. T1 was not significantly different ($p>0.05$) from T3. Percentage of medium-size group fries was higher in T3 (42 %) followed by T2 (41%), while the lowest Percentage were recorded in T1(37 %), T1 was Significantly different ($p<0.05$) in the Percentage of medium-size group fries from T2 and T3, but T2 was not significantly different ($p>0.05$) from T3.

Percentage of small-size group fries was slightly higher in T1 (46%) followed by T3 (44 %), while the lowest Percentage were recorded in T2 (42%). T1, T2 and T3 were not significantly different ($p>0.05$) from each other. As shown in Table (5).

Previous studies with larvae of striped trumpeter (Cobcroft et al., 2001; Shaw, 2006) and other species such as walleye, Sander vitreus Atlantic halibut (Naas et al., 1992), and turbot, Scophthalmus maximus showed increase in larval size in homogeneity with time and size variation in treatment that uses green algae. It is noticed that increased feed intake of live food by marine finfish in green water is also related by increased contrast between prey, and surrounding environment due to the higher scattering rate of light in green water compared with clear water environments (Cobcroft et al., 2001).

Larval quality:

Deformities rate of sea bream larvae treated with GW, Mixed and stain form after 120 days' post hatch are showed in Table (6).

Table 6: deformities rate of sea bream larvae treated with GW, Mixed and stain form after 120 days post hatch.

Treatment	Swim bladder deformities %	Operculum Deformities%
Treatment 1 GW	0. 49b± 0.00	0. 24a±0.00
Treatment 2 mixed	0. 50ab± 0.00	0. 26b±0.00
Treatment 3 stain	0. 51a± 0.00	0. 24b± 0.00

-values in the same column with different superscripts are significantly different. (Significance at 0.05)

The highest swim bladder deformities at period of 60 to 120 days after hatching was recorded in T3 with (0. 51 %) followed by T2 (0. 50 %) and the lowest swim bladder deformities was recorded at T1 (0. 49 %). Significant differences were reported between T1 and T3 while T2 did not differ significantly from the other treatments.

The highest operculum deformities at the period of 60 to 120 days after hatching was recorded in T2 was (0.26%) followed by T3 (0.24 %) and the lowest operculum Deformities was recorded in T1 (0.24%). No significant differences were recorded between T1 and T3. T2 was significantly different between T1 and T3. As shown in Table (6).

In *Sparus aurata* larvae, swim bladder inflation starts around day 8–12 and is considered a factor that affect survival rates. A reduction in swimming ability of larvae fed low nutritional value rotifers is a possible cause of the inhibition of air-intake by newly marine hatched larvae (Chatain., 1994). The development of skeletal deformity in reared marine fish has been caused by action of a great variety of causative environmental or genetic factors (Faillettaz et al., 2018).

Growth performance parameters:

Growth performance parameters of seabream *Sparus aurata* . As shown in Table (7) initial weight of seabream larvae was not significantly different ($p<0.05$) between treatments. Final weight of seabream larvae was not significantly different ($p<0.05$) between three treatments.

Table (7): growth performance parameters of seabream *Sparus aurata* (from 60 days' post hatching till 120 days' post hatching)

Treatment	T1 GW	T2 Mixed	T3 Stain
Initial-weight (g)	0.05± 0.0	0.05 ± 0.00	0.05 ± 0.00
Final-weight (g)	0.19 ± 0.0	0.446± 0.25	0.186 ± 0.00
WG (g)	0.14 ± 0.00b	0.147± 0.00a	0.137 ± .00b
ADWG	0.0019± 0.00	0.0025 ± 0.00	0.0023 ± .00
SGR%	0.966 ± 0.00a	0.989 ± 0.00b	0.955 ± 0.00a
FCR	3.55 ± 0.02b	3.27 ± 0.04c	7.94 ± 0.02a

-values in the same column with different superscripts are significantly different. (Significance at 0.05).

Weight gain (WG) of sea bream was significantly different ($p<0.05$) in T2 (0.147 g) from T1 (0.14g) and T3 (0.137g). but T1 was not significantly different from T3. Average daily weight gain (ADWG) was not significantly different ($p<0.05$) between treatments. Specific growth rate (SGR%) was significantly different ($p<0.05$) in T2 (0,989 g) from T1(0.966) and T3(0.955). but T1 was not significantly different from T3. Feed

Conversion ratio (FCR) was significantly different ($p<0.05$) between T1 (3.55), T2(3.27) and T3(7.94). Previous studies with larvae of striped trumpeter (Cobcroft et al., 2001; Shaw, 2006) and other species such as walleye, Sander vitreus, formerly Stizostedion vitreum, Atlantic halibut (Naas et al., 1992), and turbot, Scophthalmus maximus showed increase in larval size in homogeneity with time and size variation in treatment that uses green algae.

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تقييم أنظمه مختلفه لتربية يرقات أسماك الدنيس

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تهدف الدراسة الحالية إلى تقييم تأثير الاستبدال الكامل أو الجزئى للطحالب الحية المستخدمة فى نظم المياه الخضراء لرعاية يرقات أسماك الدنيس بواسطة الصبغات الصناعية المستخدمة فى تلوين الأغذية و قد شملت الدراسة ثلاث معاملات:المعاملة الأولى و هى استخدام 100% طحالب حية و المعاملة الثانية و هى استخدام 50% طحالب حية و 50%صبغة و المعاملة الثالثة و هى استخدام 100% صبغة . تم قياس جودة المياه و الطول الكلى و نسبه الإعاشة و جودة الزريعة و تبين أن أعلى نسبة أكسجين كانت فى المعاملة الثانية(5.14 جزئ فى المليون) و لا يوجد فرق معنوى فى الطول الكلى بين الثلاث معاملات و الوزن الكلى بالمجموعة ذو الحجم الأكبر كان أكبر فى المعاملة الثانية (0.26 جرام) كما شملت المعاملة الثانية أكبر عدد من المجموعة ذات الحجم الأكبر(15%) و أقل عدد من المجموعة ذات الحجم الأصغر(43%). معدل الإعاشة عند العمر 60 بعد الفقس كان الأعلى فى المعاملة الأولى بمعدل (22.77%) يليه معدل الإعاشة فى المعاملة الثانية (22.76%) بدون وجود فرق معنوى.أما معدل الإعاشة من عمر 60 يوم بعد الفقس و حتى 120 يوم بعد الفقس كان الأعلى (50.20%) فى المعاملة الثانية يليها المعاملة الأولى (49.6%). كما جاءت معدلات التشوهات منخفضة فى كل المعاملات. مما سبق نستنتج أن استخدام خليط من الطحالب و الصبغة فى رعاية يرقات أسماك الدنيس يحقق معدلات نمو واعاشة عالية مع تقليل نسب التشوهات.

الكلمات المفتاحية: الدنيس ، الطحالب الحيه ، الصبغات ، أنظمة المياة الخضراء، نسبة الاعاشه ، نسبة التشوهات.