# EFFECT OF SOME ENVIRONMENTAL CONDITIONS AND ADDITION OF PALM POLLEN GRAIN ON THE REPRODUCTIVE PERFORMANCE OF RED HYBRID TILAPIA (*OREOCHROMIS SP.*)

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## SUMMARY

This experiment was conducted at Shakshouk Fish Research Station, National Institute of Oceanography and Fisheries (NIOF), Fayoum Governorate in order to examine the possibility spawning Red tilapia on water and under conditions of Lake Qarun (fish added newly-Lake) and the possibility of improving spawning these fish through the experience has been outdoor (lighting natural) and indoor with evaluation of supplementation diets with palm pollen grains at level (zero and 1%) for each ponds indoor and outdoor. Results showed that possibility spawning Red tilapia under conditions of Lake Qarun. Addition palm pollen grains didn't affect on hatching outdoor because the biggest impact was to the environmental conditions especially the lighting. But indoor has influenced by palm pollen grains with improvement than free diets. The 1% palm pollen diet was better utilized in the indoor diets than the diet without palm pollen grains.

***Keywords:*** *Red tilapia- spawning- palm pollen grains- egg number and spawning number*

## INTRODUCTION

Red tilapia is one of the significant advanced species in tilapia farming, which was developed in the 1980s. Many of red tilapia strains were driven from *O. mossambicus*, they perform well in saline environments but may have low tolerance ~~of~~ for cold temperatures. In addition culture of red tilapia has increased rapidly in Thailand due to its greater value relative to Nile tilapia. There has also been a growing demand for live fish and fillet of red tilapia in both domestic and export markets. The principal cultured strain is Thai red tilapia, which is a hybrid comprising a gene pool of two main species*: Oreochromis niloticus* and *O. mossambicus* (McAndrew, 1981).

The effect of using palm pollen grains (PPG) on growth performance of Nile tilapia fry, was studied by Abou-Zied and Hassouna (2010) they reported that ~~(~~final weight, total gain & SGR( %/d) improved by using diet contained 12.5% PPG. These results may due to the increase in CP, EE and ash contents with the decrease of NFE content. Moreover as the level of PPG increased FCR and survival rate improved but feed cost/ 1000 fry increased. However, the increase in feed cost/ 1000 fry was still lower than the control. Palm pollen grains contains quercetin which play active role in sex reversal as reported by Taepongsorat *et al.* (2008) who indicate that quercetin might indirectly affect sperm quality through the stimulation of the sex organs, both at the cellular and organ levels, depending on the dose and the duration of treatment. Moreover Kassen *et al.* (2000) reported that beta-sitosterol, are useful for male hormone balance and prostate health and it can inhibit the function of the enzyme 5 alpha-reductase, which works to convert testosterone to a metabolite known as 5 hydroxytestosterone. By inhibiting the 5 alpha-reductase enzyme, beta sitosterol helps to maintain testosterone levels and prevent loss to testosterone metabolites that contribute to negative prostate health (Abou-Zied and Hassouna, 2010).

Bee-collected pollen improves fertility. It can reduce cholestrol levels and improve~~d~~ the condition of men with prostatitis. It seems to have the miraculous ability to restore and rejuvenate tired or ageing sex glands for both male and female, due to the natural hormonal substance that it contains. It can stimulate, nourish the reproductive system, ~~and~~ sexual stamina, and endurance also seem to be increased. Sections include sexual stamina, ptostatis (*prostatic disorders*), stimulating the ovarian function, and dealing with menstrual problems (Kamijo *et al.*, 2001). Saden-krehula *et al.* (1979) isolated and quantitively determined the following steroids in the pollen of pine (*Pinus nigra*) by radioimmunoassay and Fluor-metric methods: testosterone, testosterone together with epitestosterone, respectively, and androstenedione; progesterone by radioimmunoassay alone.

Regarding date palm pollens, El-Ridi *et al.* (1960) extracted the principal gonadotrophic substance of pollen grains with acetone. They found that one gram of pollen contains 1.05 IU of luteinizing hormone (LH) and 0.80 IU of follicle stimulating hormone (FSH). Karima *et al.* (2004) investigated the reproductive protective effects of pollen grains administered by oral route to mice at doses of 250 and 500 mg/kg. They showed that there dose significantly inhibit the cisplatin induced genotoxicity. The result suggested that an essential preventive role of the pollen grains against the chemotherapeutic induced infertility in male reproductive system.

Red tilapia was recently transported to Qaroun Lake, the aims of this study was to evaluate the ability of Red tilapia to live and spawning in the Qaroun Lake condition and methods to improve its spawning behavior.

## MATERIALS AND METHODS

The present study was conducted using the research facilities of Shakshouk Fish Research Station, National Institute of Oceanography and Fisheries (NIOF), Fayoum Governorate, Egypt. Brood stock of Red hybrid tilapia (*Oreochromis sp*.) was obtained from the K 2,1 marine fish hatchery belonging to General Authority for Fish Resource Development (GAFRD), Alexandria - Cairo road. Natural spawning experiment was performed to determine the effect of using palm pollen grains (PPG) on brood stock and to compare between natural spawning outdoor and indoor

Acclimatization of fish to salinity from 19 ‰ to 33 ‰, to be adapted to the water of Qaroun Lake salinity. Average initial weight of the brood stock was 334±50 g/ fish. The trial began 1/7/2011 and ended at 13/11/2011, (experimental duration, 132 days). Four concrete outdoor ponds were used Each pond is 2.3 m length, 1.6 m width and 1.25 m height and the water volume of each pond was 2.57 $m^3$ (water column was 0.7 m). The indoor tanks were made of fiberglass, the diameter is 1.75m and the water volume of each tank was 1.68 $m^3$ (water column was 0.70 m).

**Table (1): Composition and chemical analysis of diet (A, B) used in the first trial (Spawning).**

| **Ingredients** | **The first diet (A)** | **The second diet (B)** |
|---|---|---|
| Fish meal (55%CP) | 28 | 29 |
| Soybean meal (44 %CP) | 24 | 24 |
| Yellow corn | 38 | 38 |
| Linseed oil | 5 | 5 |
| Vit&Min | 2.5 | 2.5 |
| palm pollen grains (33%CP) | 1 | - |
| Starch | 1.5 | 1.5 |
| Total | 100 | 100 |
| *chemical analysis* | *As fed* | |
| DM | 90.86 | 89.64 |
| CP | 30.09 | 30.3 |
| EE | 8.3 | 6.6 |
| CF | 3.9 | 4.8 |
| NFE | 43.27 | 41.64 |
| Ash | 5.3 | 6.3 |
| GE, Kcal/g* | 4.419 | 4.241 |

*Notice: - Chemical analysis was determined according to (A.O.A.C, 1995) and NFE was calculated by difference., *, Calculated according to NRC (1993).*

Nine brood stocks were stocked in each pond and distributed in a sex ratio of 1 male: 2 females (i.e. 3 males: 6 females in each outdoor ponds), while six brood stocks were stocked in each indoor tank and in the same sex ratio in outdoor ponds, (2 males: 4 females) in this experiment stocking density was 3.5 fish/$m^3$. Two diets were used in outdoor ponds and indoor tanks (Table 1), the first diet (A, 30% CP) included 1% palm pollen and the second (B, 30 % CP) without palm pollen. Each diet represented in two replicates. Feeding rate was 1% of fish body weight; divided into two daily allowances at 10 a.m. and 4.0 p.m. Fry was collected every week from the date of the emergence of

fry to after absorbed yolk sac. Brood stock was removed out of the pond and then fry were collected by using hapa. Broodstock were returned to the pond after cleaning and refilling with water.

Water temperature, pH, dissolved oxygen (DO), salinity and ammonia were measured periodically in the morning and at noon by centigrade thermometer, Orion digital pH meter model 201, oxygen meter (Cole Parmer model 5946) , refractor meter and Hanna instruments test kits (HI4829) for ammonia & nitrite , respectively (Table 2).

**Table (2): Average water temperature, salinity, dissolved oxygen, water pH, and ammonia during the experimental period.**

| | Place | |
|---|---|---|
| Measurements | Outdoor | Indoor |
| Temperature | 30.5°C | 29.3° C |
| Salinity ‰ | 33.5 ‰ | 33.5‰ |
| pH | 7.15 | 7.13 |
| Dissolved oxygen, Mg/l | 7.17 | 7.18 |
| Ammonia | Not detected | Not detected |

Data obtained were spawned females number/hapa, % spawned females, seed weight/hapa, seed number/hapa, seed weight/female, absolute fecundity, number of spawning/female/period, Statistical analysis was performed using SPSS (2010). Statistical significant between treatments were evaluated at the 5 % probability level. General liner model (ANOVA) and regression analysis were used.

## RESULTS AND DISCUSSIONS

### *Water quality*

Water quality parameters recorded in this trial are shown in Table (2). The averages of water temperature, water salinity, dissolved Oxygen, water pH, and ammonia-N concentration, were 30.5°C, 33.5‰, 7.15, 7.17 and not detected for outdoor ponds, respectively. While the value were 29.3°C, 33.5 ‰, 7.13, 7.18 and not detected for indoor tanks. These values were within the acceptable limits for Red hybrid tilapia brood stock as reported by Chervinski (1982), Popma and Lovshin (1996) and Popma and Masser (1999).

### *Effect of environmental conditions (outdoor ponds and indoor tanks) on natural spawning of red hybrid tilapia brood stock.*

Reproductive performance parameters of red hybrid tilapia brood stock were more affected in outdoor ponds than indoor tanks, this is may due to the direct effect of sunlight as shown in Table (3), where the reproductive performance parameters including fry/ female, fry/kg female, fry/m², SR% for Larvae, SR% for brood stock, weight for larvae/mg and Number of spawning, were significantly higher for outdoor spawning ($P \leq 0.05$) except the SR% for brood stock. This result may be due to the Photoperiod, it's known to be an important factor influencing the seasonal reproductive cycle in many fish species which agree with Guerrero (1982), Lam (1983), Baroiller *et al.* (1997) and Trippel and Neil (2002), who reported that gonadal development and subsequent breeding in tilapia are well correlated with duration of sunlight in natural waters. Moreover, Jalabert and Zohar (1982) and Brummett (1995) who reported that Photoperiod is known to be an important factor influencing the seasonal reproductive cycle in many fish species. However, only a little information is available on the possible effects of light intensity and photoperiod on tilapia reproduction. Also, Bhujel (2000) reported that photoperiod and light intensity might play an important role in controlling reproduction. On the other hand, results of the present study disagree with those of Ridha and Cruz (2000) who mentioned that there is no any significant effect of light intensity on ~~any~~ spawning parameters and spawning data appeared to be periodic, probably related to the sampling procedure used.

### *Effect of diets on natural spawning of red hybrid tilapia brood stock.*

Reproductive performance parameters of red hybrid tilapia brood stock affected in indoor than outdoor by diets, the diet (A) which contained palm pollen grain stimulated spawning of indoor

brood stock higher than diet (B), but the outdoor brood stocks were not affected by diet A. Table (4) shows the reproductive performance parameters affected by diets regardless the lighting effect. The results cleared that there were no significant differences (P<0.05) between diet (A), which contained 1% palm pollen grain and diet (B), which is free of palm pollen grain. The higher values obtained by diet (B) such as (163, 488.1, 272.8 for fry/female, fry/kg female, fry/$m^2$, respectively) compared to values (124.1, 371.6, 198.5) for the same items. Presence of palm pollen grain in diets improved SR% and larvae weight, this result may be due to the direct effect of sunlight, which may play a big role in hatching than diets and this is cleared in comparing the values between outdoor and indoor (i.e. 211, 75 fry/female for outdoor and indoor respectively). Diet contained palm pollen grain stimulated spawning in indoor broodstock than diets free of palm pollen grain. This may due to the effects on the pituitary gland and the sex glands. This interpretation is agree with Murray and Pizoorno (1998) who reported that pollen of date palm had a history of use as male tonic to improve fertility, regarding date palm pollens, El-Ridi *et al.* (1960) extracted the principal gonadotrophic substance of pollen grains with acetone. They found that one g of pollen contains 1.05 IU of luteinizing hormone (LH) and 0.80 IU of follicle stimulating hormone (FSH).

**Table (3): Effect of environmental conditions (outdoor ponds and indoor tanks) on natural spawning of red hybrid tilapia brood stock.**

| | *condition (outdoor, Indoor)* | | |
|---|---|---|---|
| Item | Outdoor spawning | Indoor spawning | SED |
| Fry/ Female | 211.94[a] | 75.62[b] | 45.49 |
| Fry/ Kg Female | 633.21 [a] | 226.41 [b] | 163.15 |
| Fry/ m² | 340.76 [a] | 126.025 [b] | 93.61 |
| SR%, Larvae | 86.07 [a] | 75.71 [b] | 3.54 |
| SR% , Brood stock | 91.66 | 83.33 | 10.99 |
| Larvae weight, mg | 8.75 [a] | 8.50 [b] | 0.0907 |
| Number of spawning | 3 [a] | 1.5 [b] | 0.645 |

*a and b, average in the same row having different superscripts are differ significantly (P≤0.05).*

**Table (4): Effect of diets on natural spawning of red hybrid tilapia brood stock.**

| Parameter | Diets | | |
|---|---|---|---|
| | Diet (A)* | Diet (B)** | SED |
| Fry/ female | 124.10 | 163.01 | 76.11 |
| Fry/ kg female | 371.56 | 488.07 | 277.89 |
| Fry/ m² | 198.52 | 268.26 | 123.75 |
| SR% , larvae | 83.18 | 78.60 | 5.18 |
| SR%, brood stock | 86.10 | 88.88 | 11.45 |
| Larvae weight, mg | 8.68 | 8.56 | 0. 126 |
| Number of spawning | 2 | 2.5 | 0.866 |

**, Diet (A) was 30% CP, contained on 1% palm pollen., **, Diet (B) was 30% CP, free palm pollen.*

***Effect of interaction between environmental conditions (outdoor, indoor) and diets on natural spawning of red hybrid tilapia brood stock.***

Table (5) showed the reproductive performance parameter of red hybrid tilapia brood stock as affected by interaction between sunlight and diets on natural spawning of red hybrid tilapia brood stock. There were significant differences (P<0.05) between all treatments in all parameters. The results cleared that there were significant effect for fry/ female, fry/kg female, fry/m² and number of spawning, where the highest values of fry/ female was recorded with fish fed diet (B) in outdoor ponds (284.78), followed by that fed diet (A) which contains 1% palm pollen in both outdoor ponds (138.20) and indoor tanks (110), then the lowest values with fish fed diet (B) in indoor tanks (41.250). The highest value of SR% for larvae was with fish fed diet (A) in outdoor ponds (87.93), while the lowest values was for fish fed diet (B) in indoor tanks (72.99). Larvae weight /mg where the highest value was noticed with diets in outdoor ponds followed by diet (A) then diet (B) indoor tanks.

The values cleared that ponds received large amount of sunlight (outdoor) was the best in all values than indoor tanks. The effect of palm pollen grain was seen in indoor where fish fed diet (A) was better than that fed diet (B), this may due to the absence of sunlight and therefore, pollen positive effects on fertility. These results are in agreement with El-Ridi *et al.* (1960), Murray and Pizoorno, (1998), Kamijo *et al.* (2001) and Karima *et al.* (2004). The survival rate at harvest larvae for fish fed diet (A) was better than that fed diet (B) in both outdoor ponds and indoor tanks.

**Table (5): Effect of interaction between environmental conditions (outdoor, indoor) and diets on natural spawning of red hybrid tilapia brood stock.**

| Parameter | Fry/ Female | Fry/ Kg Female | Fry/ m² | SR% , Larvae | SR%, Broodstock | Larvae weight, mg | Number of spawning |
|---|---|---|---|---|---|---|---|
| Outdoor &Diet (A)* | 138.20 $^{b}$ | 413.79 $^{b}$ | 213.74 $^{a b}$ | 87.93 $^{a}$ | 88.90 | 8.75 $^{a}$ | 2 $^{a b}$ |
| Outdoor &Diet(B)** | 284.78$^{a}$ | 852.64 $^{a}$ | 476.78 $^{a}$ | 84.21 $^{a b}$ | 94.44 | 8.75 $^{a}$ | 4 $^{a}$ |
| Indoor& Diet (A)* | 110.00 $^{b}$ | 329.33 $^{b}$ | 183.30 $^{a b}$ | 78.43 $^{a b}$ | 83.34 | 8.62 $^{a b}$ | 2 $^{a b}$ |
| Indoor& Diet (B)** | 41.250 $^{b}$ | 123.50 $^{b}$ | 68.75 $^{b}$ | 72.99 $^{b}$ | 83.34 | 8.37 $^{b}$ | 1 $^{b}$ |
| SED | 48.50 | 145.31 | 89.097 | 5.174 | 18.84 | 0.095 | 0.9 |

*a and b, average in the same column having different superscripts are differ significantly (P≤0.05).*
**, Diet (A) was 30% CP, contained on 1% pollen palm.*
***, Diet (B) was 30% CP, free pollen palm.*

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## تأثير بعض الظروف البيئية وإضافة حبوب لقاح النخيل على مظاهر التناسل للبلطى الأحمر

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### الملخص العربى

أجريت هذه التجربة في محطة بحوث الأسماك بشكشوك- محافظة الفيوم- المعهد القومى لعلوم البحار والمصايد وذلك لدراسة إمكانية تفريخ البلطى الأحمر على مياه وتحت ظروف بحيرة قارون (نقلت حديثا للبحيرة) وإمكانية تحسين تفريخ هذه الأسماك وذلك من خلال تجربة تمت خارج المعمل (إضاءة طبيعية) وداخل المعمل مع تقييم إضافة حبوب طلع النخيل على العلائق المقدمة للأمهات بمستوى (صفر و ١%) لكل من الأحواض داخل وخارج المعمل وقد أظهرت النتائج إمكانية تفريخ البلطى الأحمر تحت ظروف بحيرة قارون ولم تؤثر إضافة حبوب لقاح طلع النخيل على التفريخ خارج المعمل نظرا لان التأثير الأكبر كان للظروف البيئية وخاصة الإضاءة أما داخل المعمل فقد اثرت إضافة حبوب لقاح طلع النخيل معنويا حيث أدى لتحسن التفريخ عن العلائق الخالية منه