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ADAPTATION OF THE NORTH AFRICAN GREEN WATER FROG, REARED IN CAPTIVITY, TO INERT FOOD

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Abstract- The question of adaptation to inert food is the most complex when talking about frog rearing in captivity, because frogs eat exclusively moving preys in natural conditions. The solution is to find a way to make the food attractive so that the frogs will eat it. Some frog-farmers mix the diet with live fly larvae which they reduce progressively until the frogs accept voluntary the inert food. The work reported here examined the effects of this progressive adaptation on performances of the North African green water frog reared in captivity. The results show that after two months of feeding froglets with fodder granules plus live domestic fly larvae, it is possible to eliminate the larvae completely from the frogs' diet.

Keywords- North African green water frog, inert food, rearing, captivity

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Introduction

One of the crucial points in starting the fattening of newly metamorphosed frogs is feeding [1]. It should be kept in mind that newly metamorphosed frogs not only have to adapt to an amphibious way of life but also must become accustomed to their new food in this context. Among the chief problems is the need to add movement to the food in their diet so that it will be recognized and eaten by the frogs, together with providing a diet that will cover all the quantitative and qualitative nutritional requirements of the animals and a suitable way of supplying it to them [2-7].

Many of the systems employed in farming of the American bullfrog (*Rana catesbeiana*) employ a diet based on the idea proposed by [8]: the use of feeds formulated for carnivorous fish, especially trout, mixed with live domestic fly larvae, whose movements lead the fodder itself to move. To date, the results obtained with such system are considered to be satisfactory.

However, once the frogs have accepted a diet moved by live fly larvae, attempts are made to reduce these and even suppress them entirely, until the animals begin to feed exclusively on fodder. In experiments carried out with *R. catesbeiana*, to date, a noteworthy reduction has made in the number of fly larvae added to the feedstuff: from 30% of the total diet at the start of feeding to 5% at the end [3,6]. Nevertheless, it has not proved possible to suppress the addition of larvae completely.

The work reported here investigated a progressive reduction in the quantity of fly larvae added to induce movement in the foodstuff over different time-spans. The aim was to discover the most suitable moment for removing the larvae from the diet during the initial fattening period for the North African green water frog *R. saharica* (Boulanger, 1913) reared in captivity and whether this species can satisfactorily accept total removal of live fly larvae from its diet.

Materials and Methods

Animals

Several spawn of *R. saharica* were raised under controlled conditions of lighting, temperature and feeding until froglets were obtained. Then, batches of 26 froglets (with an average weight of 0.85±0.05 g/froglet) were formed and kept for 120 days in nine cages built for the purpose. The rearing density was 100 frogs m^{-2}. The cages were located in a room with controlled temperature, lighting period and relative air humidity: 20-24°C, 12 hrs. of light and 12 hrs. of darkness, 50-70% humidity. The routine for handling the animals consisted of 4-day cycles: day 1: feeding, day 2: foodstuff remaining available, day 3: cleaning and day 4: fasting. The frogs were fed on extruded granulated fodder (the granules measuring 2×3 mm), without additives, that is formulated and sold for use with trout. Its composition included 46% protein, 22% fat and 13.5% carbohydrates. Movement was induced in this feed by adding live fly larvae (*Musca domestica*).

Three feeding protocols were tested, each in triplicate :

A0. Feed plus live fly larvae for the whole trial period.

A1. Feed plus live fly larvae, these being progressively reduced as from 1 month after the start of feeding onwards.

A3. Feed plus live fly larvae, progressively reduced as from 2 months after the start of feeding onwards.

The progressive reduction in the amount of live fly larvae was implemented in the following way: at the start, larvae were added at a proportion of one larva per frog: i.e., 26 larvae per cage. Thereafter, eight fewer larvae were given at each feeding session, beginning either 1 or 2 months after the start of the experiment according to whether it was protocol A1 or A2, respectively. Hence, starting with 26 larvae, the first reduction in feeding gave 18 larvae, the second 10 larvae; the third 2 and no larvae were given in later feeds up to the end of the experiment, only fodder being provided.

Variables Studied

Daily visual inspection of the animals was carried out, any losses due to death being recorded and the cadavers removed. Also, every fortnight the animals were weighed. From these data, the following parameters were calculated ("Pf" is the weight at the end of the experiment, "Pi" is the weight at the start and "t" is the number of days):

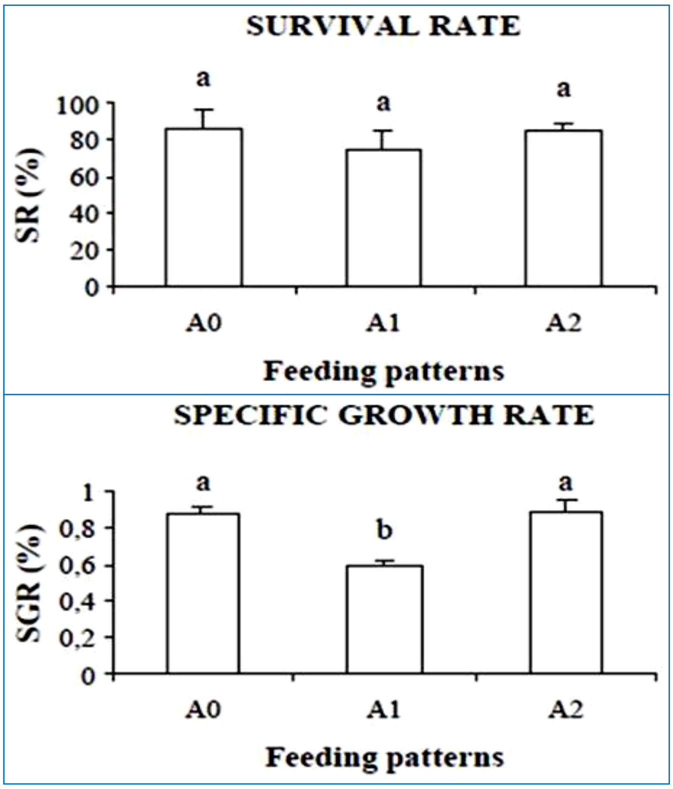
- The percentage survival rate (SR),
- Average weight,
- Specific growth rate (SGR) (% weight/day)=(lnWe-ln Ws)*100/t, where We is the average weight at the end of the experiment, Ws the weight at the start of the experiment and t is the number of days.
- Gained weight (GW) (%)=((We-Ws)/Ws)* 100.

These data were first normalized by means of an angular transformation and then compared using the Student-Newman-Keuls test (*P <0.05*).

Results

Over the course of the 120 days of the study, no type of illness was observed in the frogs with any of the feeding protocols tested.

The survival rate [Fig-1] was high for all three feeding protocols (86.53%, 75% and 84.62% with A0, A1 and A2, respectively), and no significant differences were observed between them. Deaths occurred during the first 3 weeks of the study, the dead frogs being cachectic and lacking any stomach content whatsoever.



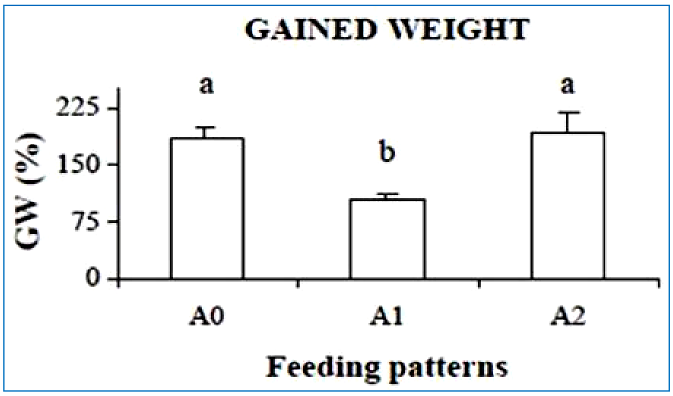


Fig. 1- Survival rate and growth parameters. The survival rate (SR), specific growth rate (SGR) and gained weight (GW) are shown for the feeding patterns A0 (fodder plus larvae throughout the study), A1 (fodder with a reduction in the larvae given after 1 month of amphibious life) and A2 (fodder with a reduction in the larvae given after 2 months of amphibious life). The results are indicated as means and standard deviations (±S.D.). Columns with the same letter do not differ significantly (*P<0.05*).

The highest specific growth rates relative to weight [Fig-1] were found in animals fed using protocols A0 and A2 (0.87% and 0.89%, respectively). Protocol A1 had a significantly lower value (0.59%). Likewise, gained weights [Fig-1] were significantly higher with protocols A0 and A2 (at 185% and 192%, respectively), while the percentage observed with protocol A1 was significantly lower (103%).

[Fig-2] shows the average weights attained by the animals each fortnight during the study period. No large differences in weight among the animals from the same batch were noted under any of the experimental conditions, such that the groups were homogenous throughout.

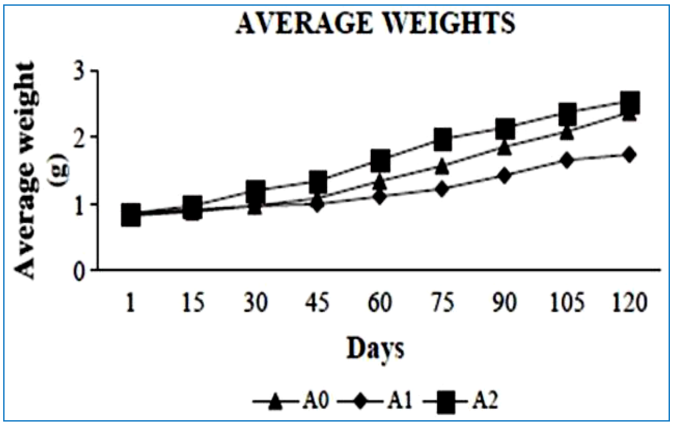


Fig. 2- Average weights. The average weights of frogs each fortnight are shown for the feeding patterns under trial (A0: fodder plus larvae throughout the study, A1: fodder with larva reduction after 1 month of amphibious life and A2: fodder with larva reduction after 2 months of amphibious life).

Discussion

When frogs are being reared, inducing movement in the diet during the early stages of growth after metamorphosis appears to be essential for the froglets to learn how to eat the fodder provided [9].

All the literature published regarding this issue refers to the rearing in captivity of the American bullfrog (*R. catesbeiana*). In experiments with this species, the aim was to stimulate the frogs to learn how to recognize food when not in motion, thereby permitting a gradual reduction in the use of “adornments”: items intended to encourage eating [5]. It should be borne in mind that discontinuation of a live food supplement brings with it not only a major reduction in feeding costs [10,11], but also improved hygiene in rearing installations, a decrease in the space devoted to producing fly larvae and lower staffing requirements, all of which strongly contributes to greater economy in production as a whole. In addition, a reduction seems to be beneficial in that it brings about an increased intake of fodder and a decrease in the consumption of larvae. In the case of *R. catesbeiana*, it has been demonstrated that a greater consumption of larvae relative to feed granules produces a lower biological value for the animal’s stomach contents [12] and only contributes poorly to their growth [5].

In the present work, it was observed that regarding the survival rate parameter there were no significant differences between the three feeding protocols under trial. The observations that the deaths recorded occurred early and that there was no content whatsoever in the stomachs of the dead froglets indicate that the deaths were likely to have been caused by starvation (inanition), regardless of the discontinuation of the larval supplement, since this had not yet been implemented when the deaths took place. These losses are certainly governed due to the fact that the frogs used in the trials were at a crucial point in their life cycle, when they are particularly vulnerable [13].

It should be stressed that the losses occurred before any reduction in fly larvae had taken place and not after this was implemented. This shows that the frogs adapted satisfactorily to a gradual suppression of the larva supplement both after 1 month and after 2 months from the start of feeding.

Analysis of growth parameters revealed satisfactory fattening for the feeding pattern in which larvae were nor reduced and for the pattern with a gradual suppression of the larva supplement as from 2 months after fattening began. This is supported by the absence of any significant differences between these two protocols with regard to both the specific growth rate and to the gained weight parameters. This is of great importance for raising *R. saharica* in captivity, since it implies that supplements of live items in the feed can be completely eliminated as from 2 months of development after metamorphosis, and hence foodstuffs can be supplied fully motionless to the frogs from that point onwards. The importance of this for the economics of future farms devoted to raising green water frog, from *R. esculenta* complex, is obvious.

Likewise, the results show that suppressing the fly larva supplement to the diet 1 month after the postmetamorphosis fattening of *R. saharica* has begun is premature. This may be due to the fact that a single month is too short a time for the frogs to become accustomed to eating fodder alone.

In contrast to this striking result when rearing *R. saharica* in captivity, [14], referring to bullfrogs, advocated maintaining the fly larva supplement for the whole period of fattening. The aim of this would be to reduce inequalities in weight between frogs, but in the work presented here no heterogeneity was detected in the weights of the animals in any of the batches used. This points to no use being made of live larvae in fattening *R. saharica* after the first 2 learning months and again supports the validity of the results obtained.

Conclusion

After 2 months of feeding *R. saharica* froglets with fodder granules plus live domestic fly larvae, it is possible to eliminate the larvae completely from the frogs’ diet.

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