Journal of
Fisheries and Aquatic Science

ISSN 1816-4927

Academic Journals Inc.

www.academicjournals.com

Journal of Fisheries and Aquatic Science 9 (6): 483-486, 2014
ISSN 1816-4927 / DOI: 10.3923/jfas.2014.483.486

Predatory Size of Dragon Fly (*Palpopleura lucia* (Drury, 1773)) Nymphs on Guppy (*Poecilia reticulata* (Peters, 1859))

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ABSTRACT

Attainment of adulthood by a young fish is a function of environment, competition, starvation, cannibalism and predation amongst other factors. Predators do not exhibit predatory qualities from birth, it has to grow over time before the qualities are expressed. Thus, the aim of this study was to determine minimum size of dragonfly (*Palpopleura lucia* (Drury, 1773)) nymphs (Naiads) that can predate on guppy (*Poecilia* reticulata) (Peters, 1859)) with a view to understanding predation in aquaculture. Guppies of 5-12 mm total length were introduced to naiads of varying lengths ranging from 2.00-10.00 mm over a 48 h period. Results obtained showed that naiads ≥6.00 mm were able to predate on guppies while those ≤5.5 mm co-habited with guppies without predation. This study thus concludes that aquaculture management practices can be geared towards eliminating naiads ≥6.00 mm, this will hopefully assist farmers to optimize human and material resources expended in the control of naiads in aquaculture.

Key words: Aquaculture, naiads, prey, predator

INTRODUCTION

Cumulative survival during the early life history of fish is influenced by both growth and mortality rates (Pepin, 1991; Pepin *et al.*, 1992). In natural environment or outdoor nursery ponds, the post-larvae and fry are susceptible to predation not only by predatory fish but also by notonectids, amphibians and insect larvae (Pillay, 1990). The predator-prey interaction is the basic direct link between two species (Nomura *et al.*, 2011) but predator to prey size ratios vary substantially between species and life stages (Baras and Jobling, 2002). Understanding the effects of competitors and predators on the behavior of interacting species can identify the mechanisms of selection that are responsible for differences within populations in life history traits (e.g., growth, reproductive success) (Figiel and Miller, 1994). Besides, various parameters relating to the predator (size, gape, swimming speed, visual acuity, hunger level and prey selectivity), prey (density, body size, evasiveness and conspicuousness) and the environment (light, turbidity, other predators, alternate prey) influence each phase of the predation process (Rao, 2003). Out of the 28 orders of Class Insecta, 4 orders namely Hemiptera, Coleoptera, Odonata (Dragonflies and Damselflies) and Diptera are relatively more common in freshwater ponds. They first 3 are objects of concern in aquaculture while the last one is of economic benefit to aquaculture (Pandey and Shukla, 2005;

Gupta and Gupta, 2006). The nymphs of odonates (naiads) are major freshwater predators and some can be aquatic pests; in private and commercial fish ponds, the larger nymphs can cause economic losses by killing small fish (Hill, 1994). These nymphs may have 9-15 instars, they show the instincts to kill even when not necessary but because of abundance of prey (Hassan, 2010). Thus, the aim of this study was to determine the minimum size of dragonfly nymphs (naiads) that can predate on guppy with a view to understand predation in aquaculture.

MATERIALS AND METHODS

Major fish species of aquacultural importance in Nigeria are Catfish and Tilapia but due to logistic reasons, guppy was used for this study. This study was carried out in December, 2011. *Poecilia reticulata* (Peters, 1859) of 5-12 mm total length were collected from a perennial stream that flows through the Teaching and Research farm of the Department of Wildlife and Fisheries Management (now Aquaculture and Fisheries Management), University of Ibadan, Nigeria. After collection from the stream, the fish were acclimatized in a rectangular plastic aquarium 45×28×24 cm^3 for 48 h before being graded into sizes based on length (Pepin *et al.*, 1992) and were each separated into 650 mL disposable plastic lunch box 15×10×5 cm^3 containing 200-300 mL water and some branches of *Elodea* sp. The *Elodea* was to provide shade since earlier field observations showed that the naiads attach themselves to its branches. Naiads were also collected from one of the earthen nursery ponds at the same site and were acclimatised in a cylinderical plastic aquarium for 48 h before the commencement of the experiment. A net was dragged in the pond and lots of *Elodea* was collected along with the naiads and it was kept along with the naiads in the plastic aquarium during acclimatization. For the body measurement, the organisms (guppy and naiads) were singly put inside a small glass (Robb ointment) bottle containing 3-5 mL of water, the bottle was placed on a ruler and the length of the organism was measured against the ruler underneath the bottle. A pasteur pipette was used to pick the small naiads while bigger ones were picked using a plastic spoon. After the measurements, a naiad (predator) and guppy (prey) were then kept together in the disposable plastic lunch box. The prey and predator were thus kept for 48 h during which 2 mL of fresh pond water was poured every 8 h into the rearing plastic using a pasteur pipette. The pond water was collected from a pond containing *Clarias* and *Tilapia* sp. and is believed to contain planktons that can be fed on by the organisms (especially guppy), no other supplementary feeding was introduced so that the naiads could be pushed to their starvation limits and then attack the guppy. The size of naiads used ranged from 2-10 mm while the size of guppy exposed ranged from 5-12 mm, this was replicated 5 to 9 times based on the population of naiads found in a particular class, the class was defined based on a difference of 0.5 mm. To determine the extent of predation by a particular class of naiads, number of predation per replication was multiplied by factor of 100 and it thus formed percentage predation (Table 1).

RESULTS

The population of naiads used was dependent on what was captured from the wild, this accounts for the unequal number of replications ranging from 5-9. In like manner, the length of guppies captured ranged between 5-12 mm, the smallest guppy (prey) captured being 5 mm long compared to the smallest naiad (predator) of 2 mm (Table 1).

Percentage predation was plotted against size of naiads and this showed the minimum length of naiads that can predate on guppy (Fig. 1).

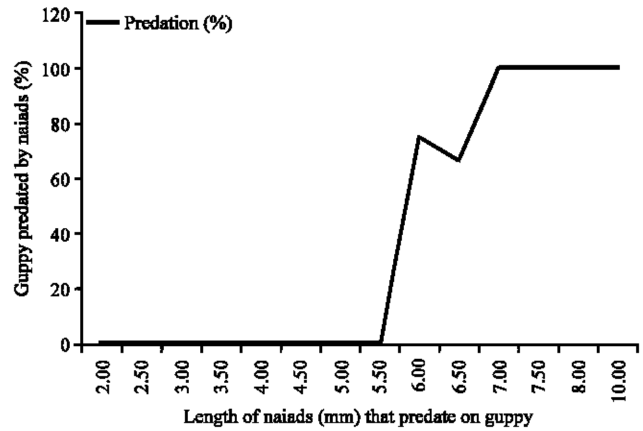

Fig. 1: Graph showing the minimum size of naiads that could predate on guppy

Table 1: Length of (predator) naiads, number of replication and corresponding length of prey (guppy)

Naiads length (mm)	Replication	Predation	Predation (%)	Guppy length (mm)
2.00	5	0	0	5.00
2.50	5	0	0	6.00
3.00	9	0	0	8.00
3.50	8	0	0	8.00
4.00	5	0	0	10.00
4.50	5	0	0	10.00
5.00	8	0	0	10.00
5.50	9	0	0	10.00
6.00	8	6	75	12.00
6.50	6	4	66.67	12.00
7.00	7	7	100	12.00
7.50	7	7	100	12.00
8.00	8	8	100	12.00
10.00	5	5	100	12.00

DISCUSSION

Laboratory and field studies have shown that both invertebrate and vertebrate predators can feed heavily on the early life history stages of fish (Pepin *et al*., 1992) but the difficulty in assessing the natural mortality of fish larvae and estimating the impact of predation *in situ* has led many scientists to study predation in the laboratory (Monteleone and Duguay, 1988; Nguenga *et al*., 2000). Yong-Sulem *et al*. (2007) reported adult amphibians, aquatic insects and flying predators as being responsible for 28, 6 and 23% of the fry mortality which was observed in unfenced catfish nursery ponds. This present study revealed that naiads of *Palpopleura lucia* at a nymphal stage with size of 6.00 mm and above were strong enough to attack guppies and guppies ranging up to 12 mm were predated upon by the naiads. The result of this study is in agreement with Gupta and Gupta (2006) who reported Hemipterans (*Notoneeta*, *Anisops* and *Plea* sp.) and Colepterans killing and eating Carp fry of 10-13 and 20-24 mm, respectively. This result is also an indication of the fact that naiads $\leq$5.5 mm may not pose a threat of predation in fish nurseries. It was also observed that the naiads used sit and wait foraging strategy as classified by Nomura *et al*. (2011), they waited until the prey (guppy) comes near and they strike out with their pincers like lip, this is used to hold the prey until the prey becomes lifeless or cut into two as with the small naiads, a part of the prey is consumed while the other part slips away. Whereas the bigger naiads hold the prey tightly and consume it simultaneously, they eat up all the prey. This is corroborated by Hassan (2010) who reported that Libellud larva has a unique feeding mouthpart, which functions like a hydraulic system and is quite efficient in its operation of catching live prey. Hours after predation and consumption however, some of the smaller naiads end up dead but the reason behind this could not be ascertained.

CONCLUSION

Aquaculture management practices could be geared towards eliminating the big sized naiads of $\geq$6.00 mm. As such, this will hopefully assist farmers to optimise the human and material resources expended in the control of naiads in aquaculture.

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