

Diet, reproduction, settlement and growth of *Palio dubia* (Nudibranchia: Polyceridae) in the north-west Atlantic

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Egg masses, juveniles and adults of the gastropod Palio dubia were found in shallow rocky habitats of eastern Canada dominated by the bryozoan Eucratea loricata. Multiple-choice experiments and direct field observations revealed that P. dubia prefers to feed on E. loricata. Courtship, copulation and egg-laying as well as hatching of P. dubia were closely related to the lunar cycle. Reproduction was preceded by increased pairing and aggregative behaviour. The duration of embryonic development in the capsules was 10–15 d. After hatching, most veligers were retained within the bryozoan branches during their pelagic phase (1–3 d). In multiple-choice experiments, settlement occurred preferentially on the bryozoan E. loricata. In the absence of the preferred substratum, the larvae continued to swim and died after a period that never exceeded 8 d. Juveniles remained associated with the bryozoans on which they settled and reached the adult size in ~3 months.

Keywords: nudibranch, feeding, spawning, lunar cycle

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INTRODUCTION

In light of their popularity with naturalists and scientists, and of the ecological role they play in marine benthic habitats, little quantitative data have been gathered on nudibranchs worldwide (Karlsson, 2001). The feeding habits, reproductive cycles and larval biology of most species have yet to be fully elucidated, and this relative scarcity of published data may in part be due to the sporadically explosive breeding mode of most opisthobranchs (Beeman, 1977; Hamel & Mercier, 2006).

While nudibranchs are perhaps the best studied group among the opisthobranchs (Hadfield & Switzer-Dunlap, 1984), publications on the reproduction, development and feeding of these molluscs in the north-west Atlantic remain limited, and even less information is available on species from eastern Canadian waters. The few accounts published in the literature include life history observations of *Onchidoris bilamellata* in Nova Scotia (Bleakney & Saunders, 1978), the effect of temperature on the development of egg masses of *Dendronotus frondosus* in New Brunswick (Aiken, 2003; Watt & Aiken, 2003), and general zoogeographical studies by Franz (1970) and Meyer (1971).

Extreme feeding specificity is typical of nudibranchs, with diets frequently limited to a single prey species (Thompson, 1964). According to Swennen (1959) the relationship of nudibranchs to their prey species often approaches ecto-

parasitism. Reproductive structures of nudibranchs are rather complex, and their mating behaviours can be very elaborate (Hyman, 1967; Hadfield & Switzer-Dunlap, 1984; Karlsson & Haase, 2002), although reports of these behaviours are commonly reduced to anecdotal statements (Karlsson, 2001).

The nudibranch *Palio* (= *Polycera*) *dubia* (Sars, 1829) can be found in the north-west Atlantic, from the Arctic down to Connecticut, USA (Clark, 1975), as well as in the north-east Atlantic (Jensen, 2005), in the north-east Pacific (Goddard, 2004), and in the White Sea, Russia (Mileikovsky, 1970). This species is poorly known, with information limited to a study by Clark (1975) suggesting that its diet includes the bryozoan *Cryptosula pallasiana*, its settlement occurs in March, and that individuals grow to sexual maturity by April and die in June. Observation of larvae in the plankton in the White Sea when the seawater temperature is around 6.5–7.5°C suggests that spawning occurs in July and August (Mileikovsky, 1970). Finally, Thompson & Brown (1984) mentioned that *P. dubia* possessed oocytes of 79 µm in diameter, which developed into a planktotrophic larvae, while Rivest (1984) described their copulation via hypodermal injection. Investigations conducted on other temperate species related to *P. dubia* include a recent account of the development of *Polycera aurantiomarginata* and *P. quadrilineata* in Spain (Martinez-Pita *et al.*, 2006), and research on the damage caused to arborescent bryozoans by *P. hedgpethi* in Australia (Bone & Keough, 2005).

The present study combined field observations and laboratory experiments to assess the feeding preferences, aggregative behaviour, reproduction, development, larval settlement and growth of *Palio dubia*, thus shedding new light on the

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