

UNIVERSITY OF CALIFORNIA  
Santa Barbara

Factors Regulating Predation on Crab Embryos by the Nemertean,  
Carcinonemertes: The Role of Host Ecdysteroids

A Dissertation submitted in partial satisfaction  
of the requirements for the degree of

Doctor of Philosophy

in

Biology

by

Robert Koichi Okazaki

RECEIVED  
SEA LIBRARY

Committee in charge:

Professor Armand M. Kuris, Chairman  
Associate Professor Ernest S. Chang  
Professor Daniel E. Morse  
Professor Alice L. Alldredge

December 1988

Dennis Hedgecock, Ron Hedrick, Keith Nelson, Steve Obrebski, and Jon Shenker throughout my years at the Bodega Marine Laboratory. I appreciate the friendship of Drs. Tom and Lou Fletcher, Dorothy Lowry, Ursula and Arnie Rodgers, and Jackie and Paul Brown. I thank my brother, David, and Linda Gong for their quiet support. Finally, I express my special appreciation to Nicole Berthélémy-Okazaki for her love, support (both moral and financial), and tolerating my idiosyncrasies during these years of graduate studies.

I acknowledge the California Sea Grant College Program for supporting me on a Sea Grant Traineeship (RF/75 to A.M. Kuris) from 1981-1986. I am grateful for the 1986 Sigma Xi research grant and for the 1987 research assistantship provided by the Institute of Marine Resources, California Sea Grant College Program. Finally, I thank Dr. James Clegg, Director of the Bodega Marine Laboratory, for travel and miscellaneous support from the director's discretionary funds during the final stages of this research.

## ABSTRACT

### Factors Regulating Crab Embryo Predation by the Nemertean, Carcinonemertes: The Role of Host Ecdysteroids

by

Robert Koichi Okazaki

Factors responsible for the feeding and growth delay that nemertean egg predators exhibit during their early trophic phase and the role of ecdysteroids in nemertean and crab symbiosis were investigated. Ecdysteroids in embryos and sera of Cancer magister and Cancer anthonyi crabs and in nemerteans were analyzed by radioimmunoassay (RIA) and high-performance liquid chromatography (HPLC). Brooding behavior and embryogenic duration of C. anthonyi were documented. Nutritional effect on serum and embryonic ecdysteroids of brooding females, and on brood production was investigated. The ultrastructure of C. magister pleopods was examined. Age of prey egg was not a factor. An inverse relationship between worm density and feeding rate was found. Feeding rates were significantly lower at high as opposed to low worm densities. High egg mortalities were observed at the pleopodal bases. Ecdysteroids were detected in the arthrodial membranes between the walking legs. Juvenile worms appeared not to respond to either 20-hydroxyecdysone (20-HE) or lobster urine containing ecdysteroids. Cancer

magister embryos displayed biphasic patterns of ecdysteroid fluctuations during development; titers decreased until mid-embryogenesis and then increased and peaked prior to hatching with increasing ecdysone concentrations from mid-embryogenesis to hatching. Embryonic ecdysteroid titers in C. anthonyi decreased steadily from high initial concentrations. Increasing and decreasing titers were observed during the brood and interbrood periods of C. anthonyi, respectively. Cancer anthonyi produced several broods (42.4 d duration) within an instar; interbrood periods averaged about 41.7 d. Sera and embryonic titers from crabs fed a minimal diet were significantly higher compared to the controls. These crabs produced only one brood; whereas the control crabs produced several broods. Multicellular structures are present near the bases of the endopodal setae enclosed by smaller cells laden with microtubules. The structures contain extensive rough endoplasmic reticulae, mitochondria and Golgi bodies. Ecdysteroids (1-47 pg/mg) were detected in several nemertean species. Paranemertes peregrina extracts displayed peaks corresponding to ecdysone and 20-HE standards. High ecdysteroid concentrations were measured in gravid females and in the eggs of Carcinonemertes errans (47 and 105 pg/mg, respectively). Hatching times of the egg strings were shortened in the presence of 20-HE.