Rev. Biol. Trop., 36 (2A): 331-332, 1988

Prostaglandins and related compounds from the polychaete worm *Americonuphis reesei* Fauchald (Onuphidae) as possible inducers of gonad maturation in Penaeid shrimps

Luis D' Croz*, Luis Wong V.*, Gustavo Justine** and Mahabir Gupta***
*Centro de Ciencias del Mar y Limnología, Universidad de Panamá, Estafeta Universitaria, Panamá
**Dirección General de Recursos Marinos, Ministerio de Comercio e Industrias, Panamá
***Facultad de Farmacia, Universidad de Panamá, Estafeta Universitaria, Panamá

(Received April 29, 1987)

Resumen: Desde hace algunos años los cultivadores de camarones peneidos en Panamá han utilizado el gusano poliqueto tubícola *Americonuphis reesei* Facuchald (Onuphidae), como suplemento alimenticio para acortar el tiempo de maduración gonadal de especímenes de camarones *Penaeus vannamei* Boone y *P. stylirostris* Stimpson, que se preparan para su reproducción. Este poliqueto es congelado y añadido en pequeños trozos a la dieta de los camarones adultos. El análisis bioquímico del poliqueto revela una elevada concentración de prostaglandinas y compuestos relacionados de efecto conocido sobre la maduración gonadal y liberación de gametos en especies marinas. Se sugiere que el valor nutritivo del poliqueto (junto con la acción de las prostaglandinas) induce la maduración rápida de las gónadas de los camarones.

During the past few years, mariculturists in Panama have been using the Onuphid polychaete tube-worm *Americonuphis reesei* Fauchald (Fauchald 1973) as a dietary supplement in order to accelerate gonad maturation in the penaeid shrimps *Penaeus vannamei* Boone and *P. stylirostris* Stimpson. The success of this supplement has led to a small fishery of the worm and its export to shrimp farmers in Ecuador, Belize and Guatemala. The worm is frozen and fed chopped to the adult shrimps. Mariculturist's efforts to use pelletized worms failed to produce the expected results. This suggested us that the bioactive compounds are labile. Visual observation of a large lipid content in the worm tissues suggested that the active compounds might be lipidic in nature. The prostaglandins (PGs), lipid compounds derived from arachidonic acid (AA), are active molecules with high hormone like activity (Tortora and Anagnostakos 1981). These molecules are known to play an important role in the reproductive cycle of numerous species. For example, PGs induce gonad maturation and gamete release in marine bivalves and gastropods (Morse *et al.* 1977).

Aqueous homogenates of blood, muscle and digestive tract were prepared from several worms collected in the Bay of Panama. PGs and related compounds were extracted from the tissues and identified using the method of Salmon and Flower (1982). This involved the following sequence: acetone extraction, refrigerated centrifugation, hexane extraction, citric acid acidification, chloroform extraction, rotavaporation and storage in a nitrogen atmosphere. Silica-gel G (0.25 u) thin layer chromatography (TLC) was used to separate and identify the extracted substances. The solvent system was chloroform-methanol-acetic acid-water (90:8:1:0.8). Spots were detected either by iodine vapor impregnation or by spraying with 3% cupric acetate in 15% phosphoric acid, and heating at 120ºC for 10 minutes. Individual Rf values were measured and compared to those reported by Salmon and Flower (1982). To check these results, extracts were also run in argentation TLC (Andersen and Leovey, 1974). Chromatographic spots were scrapped out and detected by spectrophotometry at 278 nm (Samuelsson 1964).

Five important types of PGs and three relat-

TABLE 1

Compounds isolated by TLC from extracts of the polychaete tube-worm Americonuphis reesei *Fauchald*

Compounds	Tissue		
	Intestine	Muscle	Blood
Arachidonic Acid (AA)	+	+ +	+++
12-Hidroxiecosa-tetraenoic acid (12-HETE)	+	+ +	+ +
Thromboxane B_2 (TxB_2)	+	−	+ +
Prostaglandins A+B (PGA+ PGB)	+	−	+
Prostaglandin D (PGD)	+	−	+
Prostaglandin E (PDE)	+	+	+
Prostaglandin F (PGF)	+	+ +	+ +

(−) no spot, (+) weak spot, (++) intense spot, (+++) very intense spot

ed compounds were detected from the tissue extracts (Table 1). Both TLC and argentation TLC gave similar results. There was a difference in the quantity and quality of the recovered lipid substances depending on the type of extracts. Blood extracts showed the best recovery, whereas muscle and digestive tract homogenates gave smaller spots even with extracts of higher concentration. The total amount of PGs and other AA metabolites in blood was estimated at 2,170 ug/g of dry weight:

Compounds	AA	12-HETE	TxB_2
Yield	743	590	350

Compounds	PGA + PGB	PGD	PGE	PGF
Yield	126	87	98	485

Among the detected substances, PGE and PGF are closely involved with gonad maturation and gamete release (Morse *et al.* 1977). In addition, large amounts of AA (the poly-unsaturated fatty acid precursor of PGs) and 12-hydroxiecosatetraenoic acid (12-HETE, an AA metabolite), were abundant in the blood extracts. These results suggest that the bioactivity of the PGs found in the polychaete tube-worm together with its high nutritional value could explain why worm-supplemented diets accelerate gonad maturation in Penaeid shrimps.

ACKNOWLEDGEMENTS

The authors express their gratitude to the following for facilities and supplies: L. Alvarez and J.J. Gutiérrez (Universidad de Panamá). M. Bell (University of Stirling, Scotland) gave important analytical advises. K. Fauchald (Smithsonian Institution) identified the polychaete and J. Christy and M. Marshall (Smithsonian Tropical Research Institute) assisted in the preparation of the manuscript.

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