ANTIFOULING PROPERTIES OF THE EXTRACTS OF CHICOREUS RAMONUS

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ABSTRACT

Crude extracts of the mantle, foot, digestive gland, gonad, prostate gland, and hypobranchial gland of the gastropod Chicoreus ramonus were tested. Exposure trials were conducted at the Vellar estuary, on the southeastern coast of India for a period of one month with test panels of Mangifera indica (mango timber) treated with crude extracts mixed with abietic acid and dichloromethane. Barnacles, oyster spat and tubeosem polychaetes were common fouling organisms on the test panels. Significant inhibition was obtained with extracts of foot, mantle and prostate gland, while extracts of hypobranchial gland, digestive gland, and gonad, exerted a potent inhibitory influence against fouling organisms.

INTRODUCTION

In the mid 1960s tributyl tin (TBT), an organotin compound, was regarded as an effective antifouling compound and was commonly used in antifouling paint. However, field studies have conclusively shown that TBT contamination has resulted in massive loss of marine life (Reece et al., 1976; Langham et al., 1980). Thus, it has become imperative that marine bioactive substances be used as antifouling agents since many marine antifoulants (Turgeau et al., 1983; Ritschel et al., 1984; Standing et al., 1984; Gerhart et al., 1988) were identified to be more promising as biological control. Employing marine bioactive metabolites as antifouling agents has the added advantage of not causing any serious adverse impact on the biological systems. Sessile marine organisms such as oysters, sponges and ascidians are believed to possess chemical defense against epibiotic recruitment. Numerous marine metabolites have been assayed in both field and laboratory tests to determine their effectiveness against amphipods, polychaetes and molluscs (Fenical & Ray, 1988). It has also been reported that marine toxins and chemical secretions of the benthic marine organisms play a significant role in antifouling (Bakus & Kawaguchi, 1984; Bakus, 1991). Significant biological activity has been revealed by the toxic extracts of the predatory marine moluscan gastropod Chicoreus ramonus (Emerson & Ayakkaamu, 1991). These active extracts are also presumed to possess novel antifouling compounds. Therefore, field trials were carried out at the jetty of the Vellar estuary on the south east coast of India, to examine whether the crude extracts of Chicoreus ramonus cause any strong inhibitory influence on the settling of fouling organisms.

MATERIALS AND METHODS

Plywood panels (17x15x1.3 cm) made of mango timber (Mangifera indica) were seasoned in filtered seawater for 2-3 days. Ethanol extracts of the different parts of Chicoreus ramonus foot, mantle, gonad, digestive gland, prostate gland and hypobranchial gland were prepared by concentrating them at reduced pressure. The crude extracts (10 ml of each) were mixed with the antifouling agents abietic acid and dichloromethane. Abietic acid acts as a soluble matrix for slow leaching of the extract into the marine environment. Two grooves, 6 mm wide and 8 mm deep, were made on one side of the test panel. The mixture of crude extract, abietic acid and dichloromethane was poured into the grooves and allowed to dry. Control panels were made in similar manner. One set of control panels was treated with abietic acid and dichloromethane alone and the other set was left untreated. Treated and untreated panels were sun-
pended by a nylon rope through holes made in the center of panels and anchored in the Vellar Estuary at a depth of 1 m for a period of one month (July - August 1993). The retrieved panels were preserved individually in ethanol. Fouling organisms were counted on each panel, and the percentage coverage, biomass and extent of inhibition estimated.

Clean microscopic slides were mounted and smeared with a thin layer of extracts + hydrochloric acid and dichloromethane. A pair of control slides were treated with hydrochloric acid and dichloromethane alone, and a pair of slides were left untreated. The slides were placed in plastic tubes 4 cm diameter, bored with holes, sealed at both sides and suspended in the estuary by a long string (tine). The slides were retrieved after one month and analyzed so as to assess if the extracts inhibited growth of microbial communities.

RESULTS

Barnacles, oyster spats and tubiculous polychaetes settled on the test panels. The test panels treated with the extracts of the manacle (CRM) exhibited no significant inhibitory influence. However, a slight inhibitory influence was observed near the periphery of the grooves with an inhibition zone of 5-6 mm. Apparently CRM enhanced the settling of barnacles, oyster spats and tubiculous polychaetes. Considerable inhibition was observed on the panels treated with the extracts of foot (CRF) and the prostatic gland (CRPG) with an inhibitory range of 9 mm and 7 mm respectively. The prostate gland extract inhibited the growth of barnacles and polychaetes but not the oyster spats. A very high range of inhibition of foulers was observed on panels treated with extracts of the gonad (CRG - 16 mm), the digestive gland (CRDG - 14 to 15 mm) and the hypobranchial gland (CRHG - 14 mm). Less and scattered settlement of oyster spats and barnacles was found on the panels treated with extracts of the digestive gland and the hypobranchial gland. Inhibition by extracts of the gonad was considerable since there was no settlement of barnacles and polychaetes and only one to two oyster spats were found. Both the controls (bare and resin treated) were heavily fouled by barnacles, oyster spats and polychaetes. The feeding rate of extracts was slow. Some of the treated extracts still remained on the panel after one month. The results of microbial fouling were interesting since the slides treated with extracts of the digestive gland, gonad and the hypobranchial gland also showed considerable inhibition of microbial growth whereas the other extracts did not exhibit any pronounced effects. The percentage of recruitment of foulers and the extent of inhibition are shown in Figs. 1 & 2.

![Figure 1: Percentage of Recruitment of Fouling Organisms on Treated Panels](image-url)

**Legend:** C1 = control; extract of C. ramose; CRF = foot, CRG = gonad, CRDG = digestive gland, CRHG = hypobranchial gland, CRPG = prostate gland, CRM = manacle.
DISCUSSION

The crude extracts of *Chicoreus ramosus* displayed promising biological potency in inhibiting the settlement of the marine foulers. The results indicate that tropical marine organisms are active in producing antifouling compounds. In comparison, Bakus & Kawaguchi (1984) and Bergquist & Bedford (1978), found evidence of more prevalent antibacterial activity in temperate than in the tropical latitudes. However, the development of a fouling community is a complex process influenced by temporary variability in growth, physical disturbances, competitive interaction of different species, grazing and predation (Sarma et al., 1991). The random growth of the primary film in most of the sides may be due to the fact that smooth surfaces could not retain the test compound which got leached away soon. But, as mentioned above, the study of fouling on surfaces is a complex process, and interpretation of the results is always a difficult matter.

REFERENCES


