Isolation and characterization of bacteriophages from *Myxococcus virescens*

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Abstract

Four bacteriophages from *Myxococcus virescens* were isolated from manure and fertilized soil samples. They were designated Mv-1 g1, Mv-1 g2, Mv-8 g1 and Mv-8 g2. Both phages Mv-1 produced clear plaques and consisted of a polyhedral head (78 x 87 nm) and a tail of 105 nm with a baseplate. Phages Mv-8 were smaller, with an isometric head of 78 nm and a tail of 50 nm and produced turbid plaques. Although the bacteriophages Mv-1 g1 and Mv-1 g2 were morphologically very similar, the adsorption of the former was strongly increased by Ca^{2+}, while that from the latter was not so affected by this ion. Phages Mv-8 could be distinguished one from the other because Mv-8 g1 adsorbed on *Myxococcus coralloides* D, but this was not so for Mv-8 g2.

Introduction

During the past decade interest in myxobacteria has considerably increased because they can be used as models to study cell differentiation and, moreover, produce a great variety of lytic enzymes and antibiotics (Rosenberg, 1984). Recently, the myxobacteria have been studied genetically since most of the genetic tools can be applied in these micro-organisms. Without any doubt, the isolation of bacteriophages from myxobacteria, and the fact that coliphage P1 could be utilized for specialized transduction in *Myxococcus xanthus* (Kaiser and Dworkin, 1975), have facilitated research which could not be previously undertaken.

Several bacteriophages have been isolated from *Myxococcus xanthus* and classified into four groups: Mx-1 (Burchard and Dworkin, 1966), Mx-4 (Campos *et al.*, 1978), Mx-8 and Mx-9 (Martin *et al.*, 1978). The group Mx-1 includes non-transducing lytic phages, while the others are generalized transducing phages. In the case of phages Mx-4 and Mx-8 it has been reported (Rodrigues *et al.*, 1980; Orndorff *et al.*, 1983) that a true lysogeny is established.

We have attempted to isolate bacteriophages for several myxobacteria. However, it has only been possible when a *Myxococcus virescens* strain was used as a host. In this paper we describe our studies on these phages.

Materials and methods

Micro-organisms and culture conditions

Myxococcus virescens, isolated in our laboratory from soil samples, was the strain used as the phage host. Other micro-organisms tested were *Myxococcus xanthus* DK101, a gift from D. Kaiser (Stanford, USA), *Myxococcus fulvus* Mx f2, a gift from H. Reichenbach (Braunschweig, FRG), *Myxococcus xanthus* ATCC 27924 and *Myxococcus coralloides* D [*Corallococcus coralloides* according to Reichenbach (1981)]. This last strain was also isolated in our laboratory (Arias

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