BACTERIOPHAGE OF PSEUDOMONAS AERUGINOSA WITH UNFAMILIAR HEAD MORPHOLOGY

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During studies of bacteriophages of Pseudomonas aeruginosa a bacteriophage with a rod-shaped head was discovered. This paper will report the morphological and some biological properties of this phage.

MATERIALS AND METHODS

P. aeruginosa (Kitasato strain) was used as host. Forty-three strains of P. aeruginosa from the culture collection of the Department of Bacteriology, School of Medicine, Kyushu University were used for determination of the lytic spectrum of the phage.

A phage of P. aeruginosa with rod-shaped head was designated as K. The host cells were cultivated in nutrient broth with aeration for 3 hr. At this time the phage suspension was added to the culture and incubation with aeration was continued for an additional 3 hr. The lysate contained approximately 10^8 to 10^10 phage particles per ml. Plaque counting and one step growth experiments were carried out according to Adams (1950). Antiphage serum was prepared in rabbits by injecting phage filtrates at 3 to 4-day intervals for 2 months.

For electron microscopy, the phage suspension was placed on a collodion membrane overlying a copper mesh screen and was shadowed with chromium. The specimens were examined using a JEM-5 electron microscope.

RESULTS

Phage morphology. The head of the K phage was oblong, approximately 80 mμ long and 40 mμ in width. The tail was 100 to 120 mμ in length and 15 to 20 mμ in width (figures 1 and 3). Phage particles with a tail twice as long as the familiar one were sometimes observed (figure 2).

Plaque morphology. The plaque of K phage was extremely minute, 0.2 to 0.5 mm in diameter, and was roughly circular in outline (figure 4). Plaques located on thinly layered agar were surrounded by a turbid halo developed to 1 to 2 mm in circumference.

Lytic spectrum. The activity of K phage was examined on 43 strains of P. aeruginosa. Only two strains including the host strain were found to be sensitive to the phage.

Heat resistance. The phage suspension in nutrient broth was heated at various temperatures for 30 min. The results are shown in figure 5.

One step growth experiment. One example of one step growth curve is presented in figure 6. The latent period was calculated to be 35 min and the rise period was approximately 50 min. The average burst size was found to be approximately 130.

DISCUSSION

The head of bacteriophage usually appears hexagonal in frozen-dried preparations and circular in air-dried preparations by electron microscopy. Bacteriophages with rod-shaped heads have been reported by few investigators. Chapman et al. (1951) examined a bacteriophage of Erwinia carotovora and described a diverse array of particles including not only the familiar type but also rod-shaped particles. A phage of Shigella sonnei was reported by Terada (1956) to have a curious morphology—a rod-shaped body with a crest-like head and a tail. Recently, a rod-shaped bacteriophage of Escherichia coli with a “bob-tail” was reported by Bystričky and Ševčovičová (1957).

In this experiment, the K phage of P. aeruginosa was found to have a rod-shaped head with a long tail. All phages of P. aeruginosa previously reported were of the usual morphology (Schultz et al., 1948; Terada, 1956; Lovas et al., 1957).

SUMMARY

A bacteriophage active against Pseudomonas aeruginosa is reported which has a rod-shaped
MORPHOLOGY OF PHAGE FOR *P. AERUGINOSA*

Figure 1. A host cell of *Pseudomonas aeruginosa* (Kitasato strain) and K phages. The heads of K phages are rod-shaped.

Figure 2. K phages. A phage particle with a tail twice as long as the familiar one is shown.

Figure 3. A host cell of *P. aeruginosa* (Kitasato strain) and K phages. Adsorption to the host cell of a K phage by its tail is observable.
Figure 4. Plaque morphology of the K phage on host strain *Pseudomonas aeruginosa* (Kitasato strain).

Figure 5. Heat inactivation of the K phage at various temperatures for 30 min.

Figure 6. One step growth curve of K phage in broth.
head and a long tail. Some fundamental biological properties of this phage are described.

REFERENCES


