Host Range of a Bacteriophage of Acetic Acid Bacteria

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We determined the host range of "*Acetobacter* bacteriophage A-1." Only *Gluconobacter* strains were susceptible to this phage; no *Acetobacter* strain was susceptible. Thus, the correct name of the phage should be *Gluconobacter* phage A-1. Susceptibility to this phage appears to be a general characteristic of the members of the genus *Gluconobacter*. The single species of the genus *Gluconobacter oxydans* contains four subspecies, and susceptibility to the phage was not confined to strains of any particular subspecies.

From a culture labeled "*Acetobacter suboxydans*" Roche strain (names in quotation marks are not on the Approved Lists of Bacterial Names [7] and have not been validly published as of 1 January 1980; hence, they have no standing in bacteriological nomenclature), Schocher et al. (6) isolated the first bacteriophage for acetic acid bacteria. These authors called this phage "*Acetobacter* bacteriophage A-1." To determine the host range of this phage, Schocher et al. tested 24 strains of *Acetobacter* and *Gluconobacter* species. In addition to the Roche strain, three strains, all of which were labeled *Acetobacter*, were susceptible. Among the 20 resistant strains were 3 *Gluconobacter* strains.

Since "*A. suboxydans*," the name of the original host of bacteriophage A-1, is actually regarded as a later synonym of *Gluconobacter oxydans* (3, 4) and since the genera *Acetobacter* and *Gluconobacter* appear to be two closely related but separate taxa (5), we wanted to determine whether bacteriophage A-1 is limited to members of only one genus or whether its host range crosses the generic border line.

MATERIALS AND METHODS

As most of the strains used by Schocher et al. (6) were designated by an American Type Culture Collection number, we were able to check the identities of these strains by consulting the most recent edition of the *Catalogue of Strains of the American Type Culture Collection* (1). Three of these strains came from our own collection. We do not know the position of one strain, *Gluconobacter oxydans* subsp. *sphaericus* IFO 12467, in the system of De Ley and Frateur (3, 4).

For our additional host range studies with bacteriophage A-1, we used 11 *Gluconobacter* strains and 4 *Acetobacter* strains. These strains were grown on liquid mannitol medium (medium 1 [1], without agar) in shaking flasks at 30°C. To determine susceptibility to this phage, we used the following two tests: an agar layer method with mannitol medium in both layers and a spot assay method with the same medium and

about 10⁸ phage (plaque-forming units) per drop. The latter method was the more sensitive (Table 1).

RESULTS AND DISCUSSION

Table 1 shows the results of Schocher et al. (6), adapted to current nomenclature, along with our results.

From these results, we drew the following conclusions: (i) of 18 *Gluconobacter* strains, 5 were susceptible to bacteriophage A-1; (ii) of 15 *Acetobacter* strains, none was susceptible; (iii) susceptible strains were found in three of the four subspecies of *G. oxydans*; (iv) all three subspecies with susceptible strains also contained strains which were not susceptible; and (v) with the exception of strain LBG B 4026, our experimental results confirm those of Schocher et al. (6).

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REPRINT REQUESTS

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TABLE 1. Susceptibility of *Gluconobacter* and *Acetobacter* strains to bacteriophage A-1

Name in <i>Bergey's Manual</i> ^a	Strain no. ^b	Name used by Schocher et al. ^c	Results of: ^d	
			Schocher et al.	This study
<i>Gluconobacter oxydans</i> subsp. <i>oxydans</i>	ATCC 15178	" <i>Acetobacter roseus</i> "	—	NT
	ATCC 15180		NT	+ ^e
	ATCC 19357	" <i>Acetobacter oxydans</i> "	—	NT
<i>Gluconobacter oxydans</i> subsp. <i>industrius</i>	ATCC 11894		NT	—
	ATCC 12302	" <i>Acetobacter industrius</i> "	+	+ ^e
	ATCC 23772		NT	—
	LBG B4026	<i>Acetobacter</i> species	+	—
<i>Gluconobacter oxydans</i> subsp. <i>suboxydans</i>	Roche E	" <i>Acetobacter suboxydans</i> "	+	+
	ATCC 621	" <i>Acetobacter suboxydans</i> "	+	+ ^e
	ATCC 9324	" <i>Acetobacter gluconicus</i> "	—	NT
	ATCC 23771	" <i>Gluconobacter oxydans</i> "	—	NT
	ATCC 23773	" <i>Gluconobacter oxydans</i> "	—	NT
	CN 2605		NT	—
	IAM 1832		NT	—
	IAM 1842		NT	—
<i>Gluconobacter oxydans</i> subsp. <i>melanogenes</i>	ATCC 9844		NT	—
	ATCC 9937	" <i>Acetobacter melanogenus</i> "	—	NT
<i>Gluconobacter oxydans</i> subsp. <i>sphaericus</i> (2)	IFO 12467	" <i>Gluconobacter oxydans</i> var. <i>sphaericus</i> "	—	NT
<i>Acetobacter aceti</i> subsp. <i>aceti</i>	ATCC 15973	" <i>Acetobacter aceti</i> "	—	NT
	LBG B4114	" <i>Acetobacter aceti</i> "	—	—
<i>Acetobacter aceti</i> subsp. <i>orleanensis</i>	ATCC 23755	" <i>Acetobacter mesoxydans</i> "	—	NT
<i>Acetobacter aceti</i> subsp. <i>xylinum</i>	ATCC 10245	" <i>Acetobacter xylinum</i> "	—	—
	ATCC 11142	" <i>Acetobacter acetigenum</i> "	—	NT
	ATCC 23767	" <i>Acetobacter xylinum</i> "	—	NT
<i>Acetobacter aceti</i> subsp. <i>liquefaciens</i>	ATCC 23749	" <i>Acetobacter aceti</i> "	—	NT
<i>Acetobacter pasteurianus</i> subsp. <i>pasteurianus</i>	ATCC 6033	" <i>Acetobacter pasteurianus</i> "	—	NT
	ATCC 9322	" <i>Acetobacter suboxydans</i> "	—	NT
	ATCC 9323	" <i>Acetobacter ascendens</i> "	—	NT
	ATCC 9325		NT	—
	ATCC 9432	" <i>Acetobacter rancens</i> "	—	NT
	ATCC 12873	" <i>Acetobacter peroxydans</i> "	—	NT
	LBG B 4097	" <i>Acetobacter rancens</i> "	—	NT
<i>Acetobacter peroxydans</i>	ATCC 838		NT	—

^a See references 3 and 4.^b ATCC, American Type Culture Collection, Rockville, Md.; CN, Welcome Research Laboratories, Beckenham, Kent, England; IAM, Institute for Applied Microbiology, Tokyo, Japan; IFO, Institute for Fermentation, Osaka, Japan; LBG, Mikrobiologisches Institut, Swiss Federal Institute of Technology (ETH), Zürich, Switzerland; Roche, F. Hoffman-La Roche & Co. Ltd., Basel, Switzerland.^c See reference 6. Names in quotation marks are not on the Approved Lists of Bacterial Names (7), have not been validly published since 1 January 1980, and therefore do not have standing in bacteriological nomenclature.^d +, Susceptible; —, resistant; NT, not tested.^e Plaques appeared only in the spot test.

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