EDWARDSIELLA, A NEW GENUS OF
ENTEROBACTERIACEAE BASED
ON A NEW SPECIES, *E. TARDA*

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SUMMARY. The authors give a full description of a new species and genus to be included in the family Enterobacteriaceae. The generic name Edwardsiella (Ewing and McWhorter) and the species name Edwardsiella tarda are suggested for use in connection with the bacteria described.

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The purpose of this paper is to provide a description of the biochemical reactions given by a group of cultures that have been collected and studied in these laboratories since early in 1959, and to report the results of preliminary serological investigations. A search of the literature did not reveal a description of a microorganism that closely resembled members of the new group, which is referred to simply as "bacterium 1483-59." The word "new" is not used without reservation, since it seemed probable that the bacteria have been isolated in the past. Further, we are informed by Dr. R. Sakazaki, of the National Institute of Health, Tokyo, (personal communication, 1964) that he presented a paper entitled "The New Group of Enterobacteriaceae, the Asakusa Group" at the 1962 meeting of the Japan Bacteriological Society and that a summary of the presentation (Japanese text) was published (Sakazaki, 1962). Dr. Sakazaki very kindly furnished the authors with a translation of the above-mentioned abstract. From this it appeared that the majority of the cultures were isolated from snakes and that the strains described were similar to those reported herein, although there were a few differences in the biochemical reactions obtained (v. inf.). Also King and Adler (1964) described the isolation of a culture of bacterium 1483-59, which they labeled the "Bartholomew group." Their

strain was examined in this laboratory (CDC No. 1795-62) and was reported in April 1962 as a member of "an undescribed group, indol positive, hydrogen sulfide positive, mannitol negative."

The 37 strains studied by the authors were submitted to the Enteric Bacteriology Laboratories during the past few years from laboratories in the United States (16 states), Brazil, Ecuador, and Israel. One culture isolated in Japan, was received from Dr. R. Sakazaki (v. sup.). The sources of these bacterium 1483-59 strains were as follows:

	<u>Human</u>	<u>Animal</u>	<u>Stock culture</u>
Feces:			
No history	18	1	
Diarrhea	5	1 (bovine)	
Carrier	2		
Wounds	5		
Blood	1		
Urine	1		
Unknown	2		
Misc.	-		1
Totals	<u>34</u>	<u>2</u>	<u>1</u>

Thirty-two of the cultures originated in 30 foci of infection within the United States and five strains were from four foci in other countries.

The majority of the biochemical methods employed were outlined by Ewing (1962). The methods used for lipolytic and alginolytic activities were the same as those mentioned by Davis and Ewing (1964) and tests for β -galactosidase activity were made according to the method of LeMinor and Hamida (1962) as employed by Lubin and Ewing (1964).

The microorganisms were Gram-negative, oxidase negative, peritrichously flagellated bacteria that utilized glucose fermentatively (method of Hugh and Leifson, 1953) and reduced nitrate to nitrite. The results obtained with the 37 cultures of bacterium 1483-59 in commonly used biochemical tests are summarized in Table 1 and those given by the strains in additional tests are listed in Table 2. Also the reactions obtained are compared in Tables 1 and 2 with

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Table 1. Biochemical reactions given by strains of bacterium 1483-59 compared with those obtained with members of certain other groups.

Test or substrate	Bacterium 1483-59 % +	<u>Salmonella</u>	<u>Arizona</u>	<u>Citrobacter</u>	<u>P. vulgaris</u>	<u>P. mirabilis</u>	<u>E. coli</u>
Hydrogen sulfide	+ 100	+	+	+	+	+	-
Urease	- 0	-	-	d	+	+	-
Indol	+ 100	-	-	-	+	-	+
Methyl red (37°C)	+ 100	+	+	+	+	+	+
Voges-Proskauer (37°C)	- 0	-	-	-	-	-	-
Citrate (Simmons')	- 0	+	+	+	d	d	-
KCN	- 0	-	-	+	+	+	-
Motility	+ 100	+	+	+	+	+	+ or -
Gelatin (22°C)	- 0	-	(+)	-	+	+	-
Lysine decarboxylase	+ 100	+	+	-	-	-	d
Arginine dihydrolase	- 0	(+)	(+)	(+)	-	-	d
				or +			
Ornithine decarboxylase	+ 100	+	+	-	-	+	d
				or +			
Phenylalanine deaminase	- 0	-	-	-	+	+	-
Gas from glucose*	+ 100	+	+	+	+	+	+
Lactose	- 0	-	d	d	-	-	+
Sucrose	- 0	-	-	d	+	(+)	d
						or +	
Mannitol	- 0	+	+	+	-	-	+
Dulcitol	- 0	+	-	d	-	-	d
Salicin	- 0	-	-	-	d	(+)	d
Adonitol	- 0	-	-	-	-	-	-
Inositol	- 0	d	-	-	-	-	-
Sorbitol	- 0	+	+	+	-	-	d
Arabinose	- 3.0	+	+	+	-	-	+
Raffinose	- 0	-	-	d	-	-	d
Rhamnose	- 0	+	+	+	-	-	d
					or +		

* Gas production amounted to 50% or more of the volume of insert tubes.

+, positive within one or two days' incubation. -, no reaction.

(+), positive reaction after 3 or more days.

+ or -, majority of strains positive, occasional cultures negative.

- or +, majority of cultures negative, occasional strains positive.

(+) or +, majority of reactions delayed, some occur within 1 or 2 days.

d, different reactions: +, (+), -.

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Table 2. Additional biochemical reactions given by cultures of bacterium 1483-59 compared with those obtained with members of certain other groups.

Test or Substrate	Bacterium 1483-59 % +	<u>Salmonella</u>	<u>Arizona</u>	<u>Citrobacter</u>	<u>P. vulgaris</u>	<u>P. mirabilis</u>	<u>E. coli</u>
Malonate	- 0	-	+	d	-	-	-
Mucate	- 0	+	d	+	-	-	+
Christensen's citrate	+ 100	+	+	+	+	+	d
					or -		
Organic acids*							
citrate	(+) 100	+	(+)	-	-	-	-
D-tartrate	+ 100	+	-	-	-	-	-
							or (+)
i-tartrate	- 0	d	-	-	-	-	-
l-tartrate	- 0	d	-	-	-	-	-
Sodium acetate	- 0	+	(+)	+			+
		or (+)					
Ammonium salts glucose							
agar	- 0	+	+	+			+
Sodium alginate	- 0	-	-	-	-	-	-
Lipases							
corn oil	- 0	-	-	-	+	+	-
triacetin	- 0	-	-	-	d	-	-
tributyryl	- 0	-	-	-	d	d	-
Maltose	+ 100	+	+	+	+	+	d
Xylose	- 0	+	+	+	d	+	d
Trehalose	- 0	d	+	+	(+)	+	+
					or +		
Cellobiose	- 0	d	-	+	(+)	(+)	-
				or (+)	or -	or -	
Glycerol	d 77	+	+	+	+	+	+
					or (+)	or (+)	
Alpha methyl glucoside	- 0	-	-	-	+	-	-
					or (+)		
Erythritol	- 0	-	-	-	-	-	-
Esculin	- 0	-	-	-	d	-	d
Beta galactosidase	- 0	-	+	+	-	-	+
				or -			or -

* Method of Kauffmann and Petersen, 1956.

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those given by strains belonging to the genera Salmonella, Arizona, and Citrobacter, by Proteus vulgaris and Proteus mirabilis, and by Escherichia coli.

Examination of the data given in the tables indicated that although cultures of bacterium 1483-59 gave reactions similar to those of members of other groups in some tests, there were many differences in the results of other tests. For example, the IMViC reactions of strains of bacterium 1483-59 were similar to those of typical E. coli cultures. However, there were 20 points of difference between the two groups, not the least of which was the rapid and abundant production of hydrogen sulfide by cultures of bacterium 1483-59. Similar wide ranges of differences were extant between the bacterium 1483-59 strains and cultures of other groups of Enterobacteriaceae. Hence, it was clear that these bacteria should be regarded as sui generis and that they should not be placed in any of the existing genera or tribes of Enterobacteriaceae. It is recognized that care should be exercised in the selection of a species name for these microorganisms since the generic name would become the basis for the tribal name if separate status as a genus is maintained. Nevertheless, it is felt that a concrete suggestion should be made in view of the fact that the vernacular names "Asakusa" and "Bartholomew" suggested by Sakazaki (1962) and King and Adler (1964), respectively, have no standing in nomenclature. Therefore, we suggest the generic name Edwardsiella for use in connection with cultures of bacterium 1483-59. Further, it is suggested that the specific epithet tarda (from Latin; slow, implying inactivity) be adopted. If these suggestions are adopted, the following nomenclature would apply:

Tribe EDWARDSIELLEAE

Genus Edwardsiella Ewing and McWhorter

Species Edwardsiella tarda Ewing and McWhorter

Sakazaki (personal communication, 1964) reported the establishment of 18 O antigen groups and 20 flagellar (H) antigens among some 200 strains. However, strains that failed to form indol and failed to decarboxylate ornithine were included. In the authors' preliminary serologic investigations of 37 strains of bacterium 1483-59, eight O antigen groups were established, ten H antigens were delineated, and 21 serotypes have been characterized thus far.

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ADDENDUM

Since this paper was prepared 26 additional cultures of bacterium 1483-59 have been received and several more O groups and H antigens have been characterized.