JOURNAL OF CLINICAL MICROBIOLOGY, July 1991, p. 1480–1485
0095-1137/91/071480-06$02.00/0

Vol. 29, No. 7

Trabulsiella guamensis, a New Genus and Species of the Family *Enterobacteriaceae* That Resembles *Salmonella* Subgroups 4 and 5

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Received 28 December 1990/Accepted 8 April 1991

In 1985 the vernacular name Enteric Group 90 was coined for a small group of strains that had been referred to our laboratory as probable strains of *Salmonella* but did not agglutinate in *Salmonella* typing antisera. By DNA-DNA hybridization (hydroxyapatite method, ^{32}P), seven strains of Enteric Group 90 were found to be closely related (98 to 100% at 60°C and 94 to 100% at 75°C) to the first strain received (0370-85). The relatedness of Enteric Group 90 to 62 strains of other species of the family *Enterobacteriaceae* was only 6 to 41%, with the highest values obtained with strains of *Salmonella*, *Kluyvera*, *Shigella*, *Klebsiella*, *Enterobacter*, and *Citrobacter*. We propose a new genus, *Trabulsiella*, with a single new species, *Trabulsiella guamensis*, for the highly related group of eight strains formerly known as Enteric Group 90. The type strain is designated ATCC 49490 (CDC 0370-85). *T. guamensis* strains grew well at 36°C and had positive reactions in the following tests: methyl red, citrate utilization (Simmons) (38% positive at day 1, 88% positive at 2 days), H_2S production, lysine decarboxylase, arginine dihydrolase (50% positive at 2 days, 100% positive at 7 days), ornithine decarboxylase, motility, growth in KCN medium, mucate fermentation, acetate utilization, nitrate reduction to nitrite, weak tyrosine hydrolysis (88% positive at 2 days, 100% positive at 7 days), and ONPG (*o*-nitrophenyl-β-D-galactopyranoside) test. The strains fermented D-glucose with gas production and fermented L-arabinose, cellobiose, D-galactose, D-galacturonate, maltose, D-mannitol, D-mannose, L-rhamnose, D-sorbitol, trehalose, and D-xylose. *T. guamensis* strains had negative reactions in the following tests: indole production (13% positive), Voges-Proskauer, urea hydrolysis, phenylalanine deaminase, malonate utilization, lipase (corn oil), DNase, oxidase, pigment production, and acid production from adonitol, D-arabitol, dulcitol, erythritol, *myo*-inositol, melibiose, α-methyl-D-glucoside, raffinose, and sucrose. There were delayed positive reactions for gelatin liquefaction (22°C), which was positive at 12 to 23 days, esculin hydrolysis (13% positive at day 1, 50% positive at 7 days), lactose fermentation (13% positive at 3 to 7 days, 100% positive at 8 to 10 days), glycerol fermentation (88% positive at 7 days), and salicin fermentation (13% positive at day 1, 88% positive at 7 days). All strains were susceptible by the disk diffusion method to colistin, nalidixic acid, gentamicin, streptomycin, kanamycin, chloramphenicol, and trimethoprim-sulfamethoxazole, and most strains were susceptible to sulfadiazine (75% susceptible), tetracycline (88%), and carbenicillin (75%). The strains were resistant to penicillin, cephalothin, and ampicillin. The strains were isolated from vacuum cleaner dust (five strains), soil (one strain), and human feces (two strains). Although *T. guamensis* can occur in human diarrheal stools, there is no evidence that it actually causes diarrhea. Its main interest to clinical microbiologists may be its possible misidentification as a strain of *Salmonella*.

Between 1985 and 1988, the Enteric Bacteriology Laboratories at the Centers for Disease Control (CDC) received seven biochemically similar strains that did not correspond to any of the named species or unnamed groups in the family *Enterobacteriaceae*. These seven isolates and an eighth found in our culture collection were given the vernacular name Enteric Group 90 (16) and studied because of their biochemical similarity to strains of *Salmonella*, particularly to *Salmonella* subgroups 4 and 5 (see Tables 6 and 7). However, the strains did not agglutinate in any of the *Salmonella* O or H antisera, a very unusual property for an authentic strain of *Salmonella*. Thus, we thought that Enteric Group 90 might be a new subgroup or species of *Salmonella*. The purpose of this study was to compare the strains of Enteric Group 90 with each other and with other members of the family *Enterobacteriaceae* by DNA hybridization and simple phenotypic tests.

MATERIALS AND METHODS

Bacterial strains. The eight strains studied at the Enteric Identification Laboratories, CDC, are listed in Table 1. Six were from Guam and were collected as part of a project to assess the level of *Salmonella* contamination in households with salmonellosis cases and the Guam environment (9). Four of these strains were isolated from vacuum cleaner contents collected at Flores Memorial Library, the main public library, which is located in the main business district in the village of Agana. It is a favorite "hangout–child-

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TABLE 1. Sources of *T. guamensis* strains

CDC strain no.[a] (other designation)	Source	Location
1789-73 (ATCC 49492)	Human stool	New York
0370-85^T (ATCC 49490)	Vacuum cleaner contents	Guam
0371-85	Vacuum cleaner contents	Guam
0148-86 (ATCC 49494)	Vacuum cleaner contents	Guam
0149-86	Vacuum cleaner contents	Guam
0254-87	Vacuum cleaner contents	Guam
2421-87 (ATCC 49493)	Human diarrheal stool	Germany
0088-88 (ATCC 49491)	Vacuum cleaner contents	Guam

[a] A superscript T indicates the type strain for the species.

sitting'' site for schoolchildren on schoolday afternoons, and there is considerable foot traffic. Strain 0254-87 was isolated from vacuum cleaner contents in the home of an 11-month-old child with diarrhea whose stool sample was positive for *Salmonella newport*. The home was described as being in immaculate condition. Strain 0088-88 was isolated from vacuum cleaner contents taken at a shoe store located about 1 mile (ca. 1.6 km) from the library. No salmonellosis was associated with this location. Strain 2421-87 (indole positive) was isolated from the stool of a 45-year-old woman with recurrent diarrhea and was first studied in Germany by two of us (S.A. and J.B.). Strain 1789-73 was found during a search of the CDC collection for additional strains and had been reported as unidentified in 1973. It had been sent in 1973 from Beth Israel Medical Center in New York City and was isolated from a human stool. No additional information was sent with the culture. Stock cultures were maintained on *Salmonella* stock culture medium at room temperature (18 to 28°C) in the dark. This medium contained 12 g of nutrient agar, 4 g of nutrient broth, 4 g of sodium chloride, and 1,000 ml of distilled water. All incubations were done at 36 ± 1°C unless otherwise noted.

Media and biochemical tests. The strains were studied with the biochemical tests (10) normally used to characterize strains of *Enterobacteriaceae* (5). Commercial dehydrated media were used whenever possible. Tests were read on day 1; day 2; day 3, 4, or 5; and day 7. A few tests were read on

TABLE 2. Relatedness of *T. guamensis* strains by DNA-DNA hybridization

T. guamensis strain (unlabeled DNA source)	% Relatedness[a] to labeled DNA from:			
	T. guamensis 0370-85^T		*T. guamensis* 1789-73	
	60°C	75°C	60°C	75°C
0370-85^T	99	100	80	85
0371-85	100	100	96	96
0148-86	100	100	98	98
0149-86	100	100	96	94
0254-87	100	100	98	100
0088-88	100	100	89	90
1789-73	99	94	100	100
2421-87	98	98	96	98

[a] The values shown are averages of two determinations. Before normalization to 100%, the percentage of DNA bound to hydroxyapatite in homologous reactions was 35 to 70% for strain 0370-85^T and 43 to 53% for strain 1789-73. The amount of labeled DNA that bound to hydroxyapatite in control reactions without unlabeled DNA was 0.7 to 2.3% at 60°C and 0.7 to 2.6% at 75°C. These control values were subtracted from all reassociation reaction values before normalization.

TABLE 3. Relatedness of the *T. guamensis* type strain to other species of *Enterobacteriaceae* by DNA-DNA hybridization

Unlabeled DNA source (strain no.)	% Relatedness at 60°C
Salmonella serotype Typhimurium, DNA subgroup 1 (LT2)	41
Salmonella serotype 60:r:e,n,x,z_{15}, DNA subgroup 3b[a] (62 = Pc217)	41
Kluyvera ascorbata (408-78)	39
Shigella flexneri (24570)	38
Klebsiella terrigena (9001-81)	38
Enterobacter agglomerans (6003-71)	38
Salmonella serotype Brookfield, DNA subgroup 5 (750-72)	37
Klebsiella pneumoniae (2)	37
Enterobacter cloacae (1347-71)	37
Salmonella serotype Phoenix, DNA subgroup 2 (6645-59)	36
Salmonella serotype Ochsenzoll, DNA subgroup 4 (1449-68)	36
Citrobacter freundii (460-61)	36
Yokenella regensburgei, formerly *Koserella trabulsii* (329-73)	35
Salmonella serotype 51:z_4z_{23}:−, DNA subgroup 3a[b] (DC5)	34
Escherichia hermannii (980-72)	34
Buttiauxella agrestis (1176-81)	34
Enterobacter gergoviae (604-77)	32
Escherichia vulneris (2898-73)	30
Cedecea davisae (3278-77)	29
Klebsiella planticola (4245-72)	28
Enterobacter agglomerans (1600-71)	28
Salmonella serotype Ferlac, DNA subgroup 6 (1411-60)	27
Escherichia blattae (9005-74)	26
Klebsiella oxytoca (13182)	24
Serratia marcescens (868-57)	24
Enterobacter agglomerans (1741-71)	23
Obesumbacterium proteus (4302-74)	22
Erwinia rhapontici (ER 106)	20
Ewingella americana (1468-78)	20
Cedecea lapagei (485-76)	20
Erwinia amylovora (EA178)	20
Rahnella aquatilis (1327-79)	20
Edwardsiella tarda (3592-64)	19
Serratia ficaria (1165-77)	18
Erwinia quercina (EQ 102)	16
Erwinia salicis (ES 102)	16
Hafnia alvei I (5632-72)	16
Yersinia enterocolitica (497-70)	16
Yersinia ruckeri (4535-69)	16
Leminorella richardii (978-82)	16
Leminorella grimontii (1944-81)	15
Erwinia mallotivora (2851)	15
Escherichia coli (K-12)	14
Erwinia carotovora (495)	14
Morganella morganii (25830)	12
Providencia rettgeri (1163)	11
Erwinia tracheiphila (ET 106)	10
Providencia alcalifaciens (3370-67)	10
Tatumella ptyseos (H36)	9
Xenorhabdus luminescens (9016-80)	9
Xenorhabdus nematophilus (9012-80)	8
Providencia rustigianii (2896-68)	8
Proteus myxofaciens (19692)	8
Xenorhabdus sp. 2 (1426-81)	8
Budvicia aquatica (442-84)	8
Proteus mirabilis (PR 14)	6
Providencia stuartii (132-68)	6
Proteus penneri (1808-73)	6
Proteus vulgaris (PR1)	6
Moellerella wisconsensis (2896-78)	6

[a] Formerly diphasic *Arizona* serotype 24:24:28.
[b] Formerly monophasic *Arizona* serotype 1,2:1,2,5.

TABLE 4. Biochemical reactions of eight *T. guamensis* strains

Test	Cumulative % positive on day:			Reaction[a] for type strain (0370-85)
	1	2	7	
Indole production		13		−
Methyl red		100		+
Voges-Proskauer (O'Meara)		0		−
Citrate utilization (Simmons)	38	88	88	$+^{2}$
H_2S on triple sugar iron agar	100	100	100	+
H_2S on peptone iron agar	100	100	100	+
Urea hydrolysis (Christensen)	0	0	0	−
Phenylalanine deaminase	0	0	0	−
Lysine decarboxylase (Moeller)	100	100	100	+
Arginine dihydrolase (Moeller)	0	50	100	$+^{3}$
Ornithine decarboxylase (Moeller)	100	100	100	+
Motility	100	100	100	+
Gelatin hydrolysis (22°C)	0	0	0	$+^{21}$
KCN test (% resistant to cyanide)	100	100	100	+
Malonate utilization	0	0	0	−
D-Glucose				
Acid production	100	100	100	+
Gas production	100	100	100	+
Acid production from:				
Adonitol	0	0	0	−
L-Arabinose	100	100	100	+
D-Arabitol	0	0	0	−
Cellobiose	100	100	100	+
Dulcitol	0	0	0	−
Erythritol	0	0	0	−
D-Galactose	100	100	100	+
D-Galacturonate	100	100	100	+
Glycerol	0	0	88	$+^{4}$
myo-Inositol	0	0	0	−
Lactose	0	0	13	$+^{8}$
Maltose	100	100	100	+
D-Mannitol	100	100	100	+
D-Mannose	100	100	100	+
Melibiose	0	0	0	−
α-Methyl-D-glucoside	0	0	0	−
Raffinose	0	0	0	−
L-Rhamnose	88	100	100	+
Salicin	13	13	88	$+^{6}$
D-Sorbitol	100	100	100	+
Sucrose	0	0	0	−
Trehalose	100	100	100	+
D-Xylose	100	100	100	+
Esculin hydrolysis	13	13	50	−
Mucate fermentation	100	100	100	+
Tartrate fermentation (Jordan)	50	50	50	+ (weak)
Acetate utilization	50	88	100	+
Lipase (corn oil)	0	0	0	−
DNase (25°C and 36°C)	0	0	0	−
Nitrate reduction to nitrite	100			+
Oxidase	0			−
ONPG test	100	100	100	+
Yellow pigment production	0	0	0	−
Citrate utilization (Christensen)	88	88	88	+
Tyrosine clearing	50	88	100	+
Lysis by *Salmonella*-specific bacteriophage O1	0			−

[a] Symbols: −, negative at end of appropriate incubation time; +, positive at 24 h (or at 48 h for tests not done at 24 h). Superscripts give the day that the reaction became positive if it was delayed.

different or additional days (see Table 4). Each strain was subcultured from its original stock culture, and the biochemical reaction tests were repeated at the same point in time.

Serotyping. Alcohol-treated antigens were tested by slide agglutination against all the O antisera included in the *Salmonella* serotyping schema (4, 13). Formalinized H antigen preparations were tested by tube agglutination against the standard *Salmonella* H antisera (4, 13).

DNA hybridization. Unlabeled DNA was isolated and purified by methods described previously (2). DNA from strain 0370-85 (ATCC 49490), later designated as the type strain of *Trabulsiella guamensis*, was labeled in vitro with $^{32}PO_4$ by nick translation by the method of Rigby et al. (17) as given in the instructions furnished with a commercial nick translation reagent (kit number 8160; Bethesda Research Laboratories, Inc., Gaithersburg, Md.). The relatedness of labeled DNA from the type strain to unlabeled DNAs from seven other Enteric Group 90 strains (Table 2) and to stock DNAs from other strains of *Enterobacteriaceae* (Table 3) was determined by the hydroxyapatite method, as described previously (2). This relatedness value, also known as the relative binding ratio, was calculated as [(% heterologous DNA bound to hydroxyapatite)/(% homologous DNA bound to hydroxyapatite)] × 100. Strains are generally considered to belong to the same species if their relatedness is 70% or greater at 60°C. Two other criteria used for including strains in the same species include (i) little change in the percent relatedness when hybridization is done at 75°C, a more stringent temperature, and (ii) a low divergence value (often less than 3 and almost always less than 5).

***Salmonella*-specific DNA probe.** Seven strains of *T. guamensis* were tested at Gene-Trak Systems, Framingham, Mass., against this company's *Salmonella*-specific (7) gene probe, which detects all seven *Salmonella* DNA subgroups. The method used was that described by Fitts (7) and by Flowers et al. (8), except that to avoid possible inhibition, our strains were not grown in *Salmonella* enrichment broth.

Antimicrobial susceptibility tests. Antibiograms were determined by the disk diffusion method of Bauer et al. (1) (see Table 5). This was done as a taxonomic tool rather than to provide information for use in modern chemotherapy. Our "taxonomic battery" of antibiotics, which has been used for all *Enterobacteriaceae* since 1972, was tested.

RESULTS AND DISCUSSION

DNA hybridization. Labeled DNA from the type strain was highly related to that from the seven other *T. guamensis* strains (Table 2). Relatedness to other members of the *Enterobacteriaceae* was clearly below the species level, and the highest relatedness was to strains of *Salmonella*, *Kluyvera*, *Shigella*, *Klebsiella*, *Enterobacter*, and *Citrobacter* (Table 3).

Nomenclatural proposals. Because of its distinctness by DNA hybridization from other *Enterobacteriaceae* and its unique phenotypic properties (Table 4), we propose that Enteric Group 90 be classified as a new genus and species in the family, for which we propose the name *Trabulsiella guamensis*. The genus name *Trabulsiella* (trah bool see ehl' lah) was derived from the surname of L. R. Trabulsi, a Brazilian bacteriologist. It honors him for his contributions to enteric bacteriology, particularly his studies on *Salmonella*, *Shigella*, and diarrhea-causing *Escherichia coli* in Brazil. The reason for coining a second name to honor L. R. Trabulsi is given in the following section. The species name, *T. guamensis* (gwam ehn' sys) was derived from Guam, the largest island of the Micronesian group in the Pacific Ocean, where the first strains were isolated. The type strain (holotype) of *T. guamensis* is designated CDC 0370-85 (ATCC 49490). It was isolated from vacuum cleaner dust contents in

TABLE 5. Inhibition of *T. guamensis* strains by our taxonomic set of antibiotics

Strain	Inhibition zone size (mm) with antibiotic[a]:												
	CL	NA	S.D.	GM	S	K	Te	C	P	AM	CB	CF	SXT
1789-73	15	23	28	25	17	24	23	27	6	6	25	10	29
0370-85	15	23	22	26	20	25	20	25	6	10	25	12	29
0371-85	15	23	23	26	18	26	20	25	6	11	25	12	28
0148-86	16	25	22	26	18	26	22	27	6	12	25	15	28
0148-86	15	24	23	28	20	27	21	27	6	18	26	10	28
0254-87	13	20	15	23	18	23	19	24	6	6	24	6	24
2421-87	15	24	21	25	19	24	18	26	6	12	21	10	24
0088-88	12	21	15	22	19	22	19	27	6	6	10	6	27
Mean	15	23	21	25	19	25	20	26	6	10	23	10	27
SD	1.3	1.6	4.3	1.9	1.1	1.7	1.7	1.2	0	4.2	5.3	3.0	2.0
% Susceptible	100	100	75	100	100	100	88	100	0	13	75	0	100

[a] Abbreviations: CL, colistin (10 μg); NA, nalidixic acid (30 μg); S.D., sulfadiazine (250 μg); GM, gentamicin (10 μg); S, streptomycin (10 μg); K, kanamycin (30 μg); Te, tetracycline (30 μg); C, chloramphenicol (30 μg); P, penicillin (10 U); AM, ampicillin (10 μg); CB, carbenicillin (100 μg); CF, cephalothin (30 μg); SXT, sulfamethoxazole (23.75 μg) plus trimethoprim (1.25 μg).

Guam, and its biochemical characteristics are given in Table 4.

Nomenclatural problems with the names *K. trabulsii* and *Y. regensburgei*. *Koserella trabulsii* and *Yokenella regensburgei* were described independently, but it was subsequently shown that they are very closely related. In 1984, Kosako et al. proposed the name *Yokenella regensburgei* for a new group of *Enterobacteriaceae* they had discovered. In 1985, Hickman-Brenner et al. proposed the name *Koserella trabulsii* for a new group of *Enterobacteriaceae* they had discovered and previously called Enteric Group 45. However, it was subsequently shown by DNA hybridization that *Y. regensburgei* and *K. trabulsii* are the same species (12). We now acknowledge that *Y. regensburgei* has priority over *K. trabulsii* because *Y. regensburgei* was published first and gained standing in nomenclature in the same issue of *The International Journal of Systematic Bacteriology* as *K. trabulsii*. In a nomenclatural sense, *K. trabulsii* should now be considered a "junior subjective synonym" of *Y. regensburgei* and thus an illegitimate name. We will now use the name *Y. regensburgei* instead of the name *K. trabulsii*. Since this name will no longer be used, we chose to honor L. R. Trabulsi by using his name for another species. In a future publication, we plan to coin a name to honor Stuart Koser.

Description of the genus *Trabulsiella* and *T. guamensis*. Strains of *T. guamensis* are gram-negative, rod-shaped bacteria that are oxidase negative, motile, fermentative, and nonpigmented and have the general characteristics of members of the family *Enterobacteriaceae*. A more complete description of *T. guamensis* is given in Tables 2 through 5. Only a few of the biochemical reactions require comment. The reaction for tyrosine hydrolysis was very unusual. On original testing, most strains were weakly or strongly positive, but on retesting, multiple tubes inoculated with the same strain at the same time sometimes had various degrees of clearing, and a few tubes were even negative. Strain 2421-87 was the only one that was indole positive.

Antibiotic susceptibility. All strains were susceptible by the disk method to colistin, nalidixic acid, gentamicin, streptomycin, kanamycin, chloramphenicol, and sulfamethoxazole. They were resistant to penicillin, cephalothin, and ampicillin and had various susceptibilities to the other antimicrobial agents tested (Table 5).

Relatedness to *Salmonella* strains. The two original strains (0370-85 and 0371-85) of *T. guamensis* (Table 1) were sent to CDC as "suspect *Salmonella*" in 1985. Although they were biochemically very similar to *Salmonella* cultures, they did not agglutinate in any of the standard *Salmonella* O or H antisera, were not lysed by the *Salmonella*-specific bacteriophage O1 (10), and did not hybridize with Gene-Trak Systems's *Salmonella* DNA probe. Strains of *T. guamensis* do not rapidly ferment lactose or sucrose but produce H_2S abundantly; thus they can resemble *Salmonella* cultures on several enteric plating media (SS agar and XLD agar) and screening tests, such as triple sugar iron agar and Kligler iron agar. Strains of *T. guamensis* are phenotypically most similar to *Salmonella* subgroups 4 and 5 (Tables 6 and 7), which are occasionally isolated from human clinical specimens.

TABLE 6. Tests useful in differentiating *T. guamensis* from *Salmonella* subgroups 4 and 5[a]

Test	% Positive		
	T. guamensis	*Salmonella* subgroup 4	*Salmonella* subgroup 5
Agglutination in *Salmonella* O antisera (higher O's)	0	100	100
Agglutination in *Salmonella* H antisera	0	100	100
Reaction with Gene-Trak's *Salmonella* DNA probe	−	+	+
Melibiose fermentation	0	100	92
Tyrosine clearing (7 days)[b]	+ (weak)	0	0
Large zones around ampicillin and cephalothin	−	+	+
ONPG test	100	0	92
Mucate fermentation	100	0	85
Dulcitol fermentation	0	0	92
Cellobiose fermentation	100	45	0
Salicin fermentation (7 days)	88	64	0
Lysis by *Salmonella*-specific bacteriophage O1	0	0	46
Gelatin hydrolysis (12–28 days)	+	+	0

[a] All values are the percentage of strains positive after 1 or 2 days of incubation unless otherwise indicated. +, usually positive; −, usually negative.

[b] These tyrosine reactions were often weaker than those typically seen with *Proteus*, *Providencia*, and *Morganella* strains and *Citrobacter diversus*.

TABLE 7. Properties of the seven subgroups of the genus *Salmonella* compared with *T. guamensis*[a]

Property or test	*Salmonella*							*T. guamensis*
	Subgroup 1	Subgroup 2	Subgroup 3a	Subgroup 3b	Subgroup 4	Subgroup 5	Subgroup 6	
DNA hybridization group of Crosa et al. (3)	1	2	3	4	5	Not studied	Not studied	Not studied
Genus according to Ewing (4)	*Salmonella*	*Salmonella*	*Arizona*	*Arizona*	*Salmonella*	*Salmonella*	*Salmonella*	Not studied
Former *Salmonella* subgenus names	I	II	III	III	IV			
Subspecies according to Le Minor et al. (13, 14)	*choleraesuis*	*salamae*	*arizonae*	*diarizonae*	*houtenae*	*bongori*	*indica*	
Usual flagellum type[b]	Di	Di	Mono	Di	Mono	Mono	Di	
Usually isolated from humans and warm-blooded animals	+	−	−	−	−	−	−	−
Usually isolated from cold-blooded animals and environment	−	+	+	+	+	+	+	+
Differential tests[c]								
Dulcitol fermentation	96	90	0	1	0	92	62	0
Lactose fermentation	1	1	15	85	0	0	25	0
ONPG test	2	15	100	100	0	92	50	100
Malonate utilization	1	95	95	95	0	0	0	0
Growth in KCN medium	1	1	1	1	95	100	0	100
Mucate fermentation	90	96	90	30	0	85	100	100
Gelatin hydrolysis[d]	−	+	+	+	+	−	+	
D-Galactouronic acid fermentation	−	+	−	+	+	100	100	100
Lysis by bacteriophage O1	+	+	−	+	−	46	88	0
D-Sorbitol fermentation	+	+	+	+	96	100	0	100

[a] Adapted from Le Minor et al. (13, 14) and Farmer et al. (5, 6).
[b] Usually monophasic (Mono) or diphasic (Di) flagella.
[c] Values are the percentage of strains positive after 2 days of incubation (based on CDC data); symbols are based on the data of Le Minor et al. (13, 14). +, 90% or more positive; −, 10% or fewer positive.
[d] The test for gelatin hydrolysis was the rapid film method at 36°C (almost all strains were negative by the CDC standard tube method at 22°C within 2 days).

Only a few biochemical tests differentiate *T. guamensis* from these two *Salmonella* groups (Table 6).

Clinical significance. The clinical significance of *T. guamensis* is unknown, but it occasionally occurs in human diarrheal stools and could cause problems in routine identification because of its biochemical similarity to *Salmonella* species. There is no evidence that *T. guamensis* can cause diarrhea, but this possibility should be investigated in future diarrheal cases that yield this new organism. We would be very interested in obtaining information and clinical histories on future isolates.

ACKNOWLEDGMENTS

We thank Mark A. Mazola of Gene-Trak Systems for arranging to have our *T. guamensis* strains tested against their *Salmonella*-specific DNA probe, and we thank the microbiologists who originally isolated and referred the strains mentioned in this study.

ADDENDUM

Since this paper was prepared, we have studied four additional strains of *T. guamensis*. Strain 0195-89 was received from the U.S. Department of Agriculture, Ames, Iowa, and was isolated from wheat flour in Oregon. Strain 0282-90 was isolated from the feces of a 44-year-old male outpatient in Germany whose diagnosis was fever of unknown origin. Strains 0283-90 and 0284-90 were isolated from environmental material not further specified, in Malaysia by a Swiss food company that submitted them to the *Salmonella* Reference Center in Bern, Switzerland. With CDC methods, strains 0282-90, 0283-90, and 0284-90 were all indole positive. When all the strains of *T. guamensis* were studied with the same biochemical tests (but with different methods), there appeared to be two different biogroups. One biogroup was positive for indole production, gelatin hydrolysis (film method, 36°C), and esculin hydrolysis. The other biogroup was negative for these three tests. These differences will be studied further, and formal biogroup designations may be proposed if the results are reproducible.

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