Three New Serotypes of *Arizona* (19:23:31, 16:29:25, 15:26:31)

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The biochemical and serological behavior of three new serotypes of *Arizona* are described. New type 16:29:25 was recovered from a snake (*Naja naja*), a rat (*Rattus rattus*), and a stool sample of a man suffering from gastroenteritis. Types 15:26:31 and 19:23:31 were obtained from snakes belonging to the species *Oligodon arnensis* and *Eryx conicus*, respectively.

The role of *Arizona* organisms in man and animals is well known. During our study on the reservoirs of salmonellae in nature, 13 serotypes of *Arizona*, including three new types, were isolated from snakes, rats, man, and millipedes (5). The biochemical and serological characterizations of three new serotypes of *Arizona* are presented here.

MATERIALS AND METHODS

Thirty-nine snakes belonging to six different species, 81 rats, 37 stool samples, and one pooled sample containing 16 millipedes were screened at Hissar for the presence of *Salmonella* and *Arizona* organisms. The techniques of isolation, identification, and biochemical and serological characterization were the same as described by Edwards and Ewing (1).

RESULTS AND DISCUSSION

Thirty-two strains were encountered from the aforesaid sources. All three new serotypes of *Arizona* (19:23:31, 16:29:25, and 15:26:31) were recorded from internal organs and the large intestines of apparently healthy snakes. Type 16:29:25 was recovered from an apparently healthy rat and from a man hospitalized for treatment of gastroenteritis (Table 1). *Salmonella hvittingfoss* also was cultured from this patient's stool.

In addition, the biochemical behavior of 27 strains of known serotypes of *Arizona*, viz., 5:1,2,5,6 (one); 9a,9c:29:31 (one); 20:29:25 (one); 26:23:21 (twelve); 26:23:30 (three);

26:24:25 (one); 29:33:21 (one); 30:26:21 (three); 1,33:23:- (two); rough:26:21 (two), were also studied. The majority of these serotypes of *Arizona*, including the new ones, gave typical biochemical reactions (Table 2). Contrary to the findings of Le Minor et al. (3) and Sakazaki et al. (4), none of our strains from snakes (twenty-three) fermented sucrose or produced indole.

Some deviations from the general pattern of biochemical reactions noted were: (i) *d*-Tartrate was utilized by all the new serotypes and also by all the strains of the known serotypes except 5:1,2,5,6; 9a,9c:29:31; 20:29:25; and 29:33:21. (ii) Mucate was not acidified by 16:29:25 (new); 20:29:25; 26:23:30 (one); 30:26:21; and rough:26:21. (iii) Stern's glycerol could not be utilized by the new type 15:26:31. Such aberrant reactions

TABLE 1. Sources of the three new serotypes of *Arizona*^a

Serotype	Strains	Source
19:23:31	1	Snake (<i>Eryx conicus</i>) pancreas and ovary
16:29:25	3	Snake (<i>Naja naja</i>) liver, pancreas and large intestine; human feces; rat (<i>Rattus rattus</i>) large intestine
15:26:31	1	Snake (<i>Oligodon arnensis</i>) kidney, testes, and large intestine

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^a Biochemical reactions of these new serotypes of *Arizona* appear in Table 2.

TABLE 2. Biochemical reactions of three new serotypes of *Arizona*^a

Substrate	19:23:31	16:29:25	15:26:31	Substrate	19:23:31	16:29:25	15:26:31
Glucose	AG	AG	AG	Salicin	—	—	—
Lactose	AG	AG	AG	Sorbitol	AG	AG	AG
Sucrose	—	—	—	Inositol	—	—	—
Dulcitol	—	—	—	Adonitol	—	—	—
Motility	+	+	+	Arabinose	AG	AG	AG
Indole	—	—	—	Rhamnose	AG	AG	AG
Methyl red	+	+	+	Raffinose	—	—	—
Voges Proskauer	—	—	—	Maltose	AG	AG	AG
Simmons' citrate	+	+	+	Mannitol	AG	AG	AG
Christensen's urea	—	—	—	Xylose	AG	AG	AG
H ₂ S	+	+	+	Cellobiose	AG	AG	AG
Lysine	+	+	+	Nitrate	+	+	+
Arginine	+ ²	+ ²	+ ³	d-Tartrate	+ ⁵	+ ¹⁴	+ ¹⁴
Ornithine	+	+	+	l-Tartrate	—	—	—
Phenylalanine	—	—	—	i-Tartrate	± ¹⁴	—	± ¹⁴
KCN	—	—	—	Sodium citrate	+ ¹	+ ²	+ ²
Mucate	+ ²	—	+ ²	Kohn gelatin	+ ⁶	+ ⁶	+ ⁶
Malonate	+	+	+	Stern's glycerol	+	+	—
				ONPG	+	+	+

^a AG, acid and gas; +, positive reaction; —, negative reaction; ±, variable reaction. Superscript numbers refer to days of incubation. All negative test reactions were incubated for 14 days (37 C) before discarding.

TABLE 3. Antigenic analysis of the three new serotypes of *Arizona* (1316-69, 1321-69, and 1332-69)

Serum	Antigen/titer	
O antigens	<i>Pc145</i>	<i>1316-69</i>
Pc145 (O19)	400	400
Pc145 absorbed by 1316-69	<25	<25
	<i>5241-58</i>	<i>1321-69</i>
5241-58 (O16)	100	100
5241-58 absorbed by 1321-69	<25	<25
	<i>5320-52</i>	<i>1332-69</i>
5320-52 (O15)	200	200
5320-52 absorbed by 1332-69	<25	<25
H antigens	<i>VD3209-54</i>	<i>1316-69</i>
VD3209-54 (H23)	12,800	12,800
VD3209-54 absorbed by 1316-69	1,000	<100
After reabsorption	1,600	<100
	<i>Cal1141</i>	
Cal 1141 (H31)	4,000	10,000
Cal 1141 absorbed by 1316-69	<50	<50
	<i>Pc155</i>	<i>1321-69</i>
Pc155 (H25)	4,000	4,000
Pc155 absorbed by 1321-69	<50	<50

TABLE 3. *Antigenic analysis of the three new serotypes of Arizona (1316-69, 1321-69, and 1332-69) (Cont'd.)*

Serum	Antigen/titer	
	<i>K16019</i>	
K16019 (H29)	10,000	20,000
K16019 absorbed by 1321-69	50	<50
	<i>Pc196</i>	<i>1332-69</i>
Pc196 (H26)	20,000	20,000
Pc196 absorbed by 1332-69	<50	<50
	<i>1106-55</i>	
1106-55 (H31)	10,000	4,000
1106-55 absorbed by 1332-69	<50	<50

have been mentioned only rarely in the literature (2).

The three new serotypes of *Arizona* were sensitive to chloromycetin, terramycin, aureomycin, neomycin, polymyxin B, streptomycin, dihydrostreptomycin, and furaltadone.

The serological identifications of O and H antigens of the new serotypes of *Arizona* were performed as indicated in Table 3.

The new serotypes of *Arizona* are therefore assigned the antigenic formulas 19:23:31, 16:29:25, and 15:26:31.

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