

SHIGELLA TYPES ENCOUNTERED IN THE MEDITERRANEAN AREA¹

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The present communication is to report the occurrence of dysentery microorganisms in the Mediterranean area. Similar data on the *Salmonella* types found in that vicinity are given by Bruner and Joyce (1946).

Between September, 1943, and October, 1945, more than 1,344 *Shigella* cultures were examined serologically and biochemically. These were isolated in the Section of Bacteriology of the 15th Medical General Laboratory during food-handler examinations and in the investigation of outbreaks of bacillary dysentery or were submitted for identification from the laboratories of U. S. Army hospital units or medical laboratories. Of the 1,344 cultures, 1,182 were recovered in Italy between January, 1944, and October, 1945. Most of the remainder were isolated in North Africa (Casablanca to Bizerte) before January, 1944, although a few cultures originated in Sicily and southern France.

METHODS

Shigella cultures were identified tentatively by slide agglutinative tests with absorbed antisera and confirmed by agglutination in serially diluted absorbed antisera or by one-tube tests (Ewing, 1944). The serological methods employed were based largely on the work of Boyd (1938, 1940) but were similar to those described by other investigators (Wheeler, 1944a, 1944b; Weil *et al.*, 1944).

All cultures were confirmed as members of the genus *Shigella* by their biochemical reactions. This included tests for the utilization of glucose, lactose, sucrose, mannitol, salicin, and citrate; for indole and hydrogen sulfide production; for urea hydrolysis; and for motility. This list was considered the minimum that could be used. Mannitol was included, not because of any value in the establishment of a culture as a member of the genus *Shigella*, but because of its differential value within the group.

More extensive biochemical studies were made when the need was indicated. Many microorganisms were encountered that proved to be different, serologically or biochemically, from the described shigellae. Some of these were studied extensively (Wheeler *et al.*, 1946; Ewing, 1946), and others are being investigated at present.

RESULTS AND DISCUSSION

Table 1 lists all of the *Shigella* types encountered in the period mentioned. All duplicate cultures were eliminated, and each tabulation represents a case or a

¹ Based upon studies made in the Section of Bacteriology, 15th Medical General Laboratory, United States Army.

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carrier. The figures for *Shigella paradysenteriae*, Flexner III (Z), and *Shigella* species, Q 771, found in hospital patients, are somewhat weighted since 18 of the former and 13 of the latter were isolated from two small outbreaks of bacillary dysentery in Algeria. Likewise, 7 of the *Shigella paradysenteriae*, Boyd IV (P 274), cultures originated in a single outbreak in Italy. All others came from sporadic cases.

TABLE 1
Shigella types encountered in the Mediterranean area

SHIGELLA	FOOD HANDLERS			HOSPITAL PATIENTS	MISC.	TOTAL
	Civilian	American	German			
<i>S. paradysenteriae</i>						
F. I (V)	3	0	4	19	1	27
F. II (W)	55	1	7	109	8	180
F. III (Z)	31	4	6	94	6	141
F. IV (B. 103)	31	0	2	26	1	60
F. V (B. P119)	7	1	1	30	2	41
F. VI (B. 88, Newcastle)	46	4	4	137	5	196
B. I (B. 170)	0	0	0	10	0	10
B. II (B. P288)	0	0	0	1	0	1
B. IV (B. P274)	12	3	0	46	0	61
B. V (B. P143)	0	0	0	1	0	1
Lavington (<i>S. etousae</i>)	12	0	1	14	2	29
Unclassified	21	1	1	24	6	53
<i>S. alkaescens</i>	11	4	4	40	3	62
<i>S. 2-193</i> (2372)	6	0	1	0	2	9
<i>S. dispar</i>	40	2	0	22	3	67
<i>S. dispar</i> -related	10	2	0	14	1	27
<i>S. sonnei</i>	71	2	4	136	16	229
<i>S. dysenteriae</i> (Shiga)	1	0	0	4	1	6
<i>S. ambigua</i> (<i>schmitzii</i>)	18	1	1	22	2	44
Species, Q771	0	1	0	46	0	47
Species, Q1167	1	0	0	8	0	9
Species, Q1030	0	0	0	8	0	8
Species (<i>Shigella</i> -like)	10	2	0	7	0	19
Paracolon, related to <i>S. alkaescens</i>	3	0	0	8	1	12
Paracolon, related to Boyd IV	1	0	0	1	0	2
Paracolon, related to Q771	1	0	0	1	1	3
Total.....	391	28	36	828	61	1,344

F., Flexner; B., Boyd.

Except for a few Algerians, the civilian food handlers listed in the table were Italian. The majority of hospital patients were U. S. Army personnel; a few were U. S. Navy personnel, French Colonial soldiers, or German prisoners of war. The miscellaneous group was made up of cultures from individuals about whom little information was obtained.

Shigella sonnei occurred most frequently. Two hundred and twenty-nine or

17 per cent of the total number of cultures were of this type. *Shigella paradysenteriae*, Flexner VI (*Shigella newcastle*, Boyd 88), was second in order of frequency (14.6 per cent); *Shigella paradysenteriae*, Flexner II (W), third (13.4 per cent), and *Shigella paradysenteriae*, Flexner III (Z), fourth (10.5 per cent).

Subgrouping of the Flexner types was not done routinely. Examination of a group of *S. paradysenteriae*, Flexner II, cultures selected at random indicated that the majority were of the IIa variety (Wheeler, 1944a), but some were IIb, and a few appeared to be neither IIa nor IIb. *Shigella paradysenteriae*, Flexner I (V), occurred much less frequently than the other members of the Flexner group (2.0 per cent) and were, for the most part, of the I type rather than the I.III or VZ (Weil *et al.* 1944), although a few of the latter were isolated.

Four other microorganisms occurred commonly. They were *Shigella dispar* (5.0 per cent), *Shigella alkalescens* (4.6 per cent), *S. paradysenteriae*, Boyd IV (P 274; 4.5 per cent), and *Shigella paradysenteriae*, Flexner IV (Boyd 103; 4.4 per cent), in the order of their frequency of occurrence.

The microorganisms which were more prevalent in the civilian food-handler applicants tended to appear more commonly in cases of bacillary dysentery. *S. paradysenteriae*, Flexner IV, and *S. dispar* are apparent exceptions to this statement. The former type was more prevalent during 1945 than during 1944. Of 17 cultures isolated during 1944, only one was recovered from a civilian food-handler applicant (Italian), whereas 15 were from hospital patients; one culture was placed in the miscellaneous group for that year. During 1945, 30 cultures of Flexner IV were isolated from civilians and only 10 originated in hospital patients. *S. dispar* appeared in food handlers more often than in patients with dysentery. Serological varieties of this microorganism occurred in cases, however, from which no other bacterium of significance was recovered. The disease was of a mild nature in most cases and tended to become chronic in some instances. The same *S. dispar* serotype was isolated repeatedly from the feces of one individual for nearly a year. During this time the person suffered recurrent attacks of diarrhea accompanied by abdominal pains.

Although the shigellae of the Boyd group other than *S. paradysenteriae*, Boyd IV (P 274), were not common, they were isolated from cases in which they were undoubtedly the etiological agent.

The cultures listed in table 1 as *Shigella* species, 2-193, are similar to *S. alkalescens* in regard to their biochemical characteristics but differ antigenically. This type is related serologically to *Shigella paradysenteriae*, Boyd V (P 143), to certain other members of the Boyd group, to *S. dispar*, and to a lesser extent to *S. paradysenteriae*, IV, V, and Y (unpublished data; Wheeler *et al.*, 1946; Carpenter and Stuart, 1946). Further studies on this interesting serotype are in progress.

Shigella paradysenteriae, Lavington, is a "new" serotype found in North Africa and Italy (Ewing, 1946). It is identical to cultures isolated in England by Lavington *et al.* (1946) and by Heller and Wilson in France (1946).

The unclassified group, which consisted of about 4 per cent of the cultures, is made up of *Shigella paradysenteriae*-like isolates. Some are related serologi-

cally to the Flexner types, some to the Boyd types, and others bear little or no sero-relation to any described type with which they were compared. This group, along with some mannitol-negative cultures, is being studied further.

Only one culture of *Shigella dysenteriae* was isolated from an Italian civilian food handler during nearly two years in Italy. Four cultures were recovered from patients in Italy (3 American, 1 Brazilian), but in each instance the history indicated that the infection was acquired outside Italy. The sixth culture (table 1) was submitted to us indirectly from the American University at Beirut.

Forty-four cultures of *Shigella ambigua*, representing 3.3 per cent of the total, were examined. Of the other mannitol-negative shigellae (Wheeler and Stuart, 1946; MacLennan, 1945), *Shigella* species, Q 771, occurred most commonly (47 cultures or 3.5 per cent). *Shigella* species, Q 1167 and Q 1030, cultures were encountered but they were not numerous. Two cultures of *Shigella* species, Q 771, labeled "inagglutinable Shiga" were received indirectly from the American University, Beirut.

Other mannitol-negative microorganisms are listed in the table as *Shigella*-like cultures. A few of these were related to known types, but in most cases they were serologically distinct from described shigellae.

Several motile cultures which proved to be identical to Sachs B.81 and B.105 and similar to no. 29911 of Stuart *et al.* (1943) were studied but were not included in table 1. Other paracolon bacteria were studied and were included in the table because of their sero-relation to *Shigella* types. Some of these, related to *S. alkalescens* or to *S. paradysenteriae*, Boyd IV (P 274), have been reported (Wheeler *et al.*, 1946). Three motile paracolon bacteria antigenically related to *Shigella* species Q 771 have also been studied and reported (Wheeler and Stuart, 1946).

SUMMARY

A report is made on 1,344 *Shigella* and *Shigella*-like cultures isolated in the Mediterranean area. The microorganisms were typed by serological methods and confirmed as shigellae by their biochemical reactions.

A table is included which lists the various types and their sources. Of the total, 828 cultures were isolated from hospital patients, 455 from food-handler applicants, and 61 made up a miscellaneous group.

The eight types encountered most frequently were as follows, in the order of their occurrence: *Shigella sonnei*; *Shigella paradysenteriae*, Flexner VI, Flexner II, Flexner III; *Shigella dispar*; *Shigella alkalescens*; *Shigella paradysenteriae*, Boyd IV (P 274); and *Shigella paradysenteriae*, Flexner IV.

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