<table>
<thead>
<tr>
<th>項目</th>
<th>内容</th>
</tr>
</thead>
<tbody>
<tr>
<td>項目</td>
<td>台湾における赤痢菌の菌型分布と薬剤耐性</td>
</tr>
<tr>
<td>作成者</td>
<td>許書刀</td>
</tr>
<tr>
<td>集成</td>
<td>長崎大学風土病紀要</td>
</tr>
<tr>
<td>言語</td>
<td>日本語</td>
</tr>
<tr>
<td>項目</td>
<td></td>
</tr>
<tr>
<td>項目</td>
<td></td>
</tr>
<tr>
<td>項目</td>
<td></td>
</tr>
<tr>
<td>項目</td>
<td></td>
</tr>
</tbody>
</table>
Type Distribution and Drug Fastness of Shigella in Taiwan

Shu-Tao HSU, M. D.
Taiwan Serum Vaccine Laboratory, Shih-lin, Taipeii, Taiwan, China.

Introduction
Taiwan is lying in subtropical and tropical zone between 21°-25° C.N. latitude. The climate is warm with high humidity so that Taiwan is a favorable place for outbreak of bacterial enteric diseases. Bacterial dysentery is one of the common diseases here round a year, but the peak will be in summer. On the other hand, the custom of inhabitants seems to be valuable for preventing the spread or explosive outbreak of bacterial dysentery, because they are not used to drink raw-water and to eat any foods uccoked. Modern trends of dysentery in Taiwan looks like mild with low mortality and no explosive outbreaks as reported in Japan. Now, dysentery is not a topic of social problem in our community and loss the majority interest of health workers.

Types Distribution
About the types distribution of Shigella in Taiwan, there are only few reports available. According to Maruyama (1912, 1916), Kurimoto and Okura (1940), Shigella dysenteriae 1 had been prevalent since 1915 to near 1940, but after that time, Shigella flexneri (Komagome-type) became the main epidemic strains of dysentery. Kurimoto and Okura pointed out that the major difference of current epidemic strains of Shigella with Japan was mannitol-nonfermenting strains, but those were not corresponding to Shigella dysenteriae 1, oftenly encountered in Taiwan. After the World War II, types distribution of Shigella in Taiwan have been reported by Wang, S.P. et al (1950), Wang, K.Y. and Liu (1950), Yang (1954), and Hsu (1962) since 1949.

Types distribution of Shigella around 1950
Wang, S.P. and others had collected 140 Shigella strains from the hospitals of northern Taiwan in 1950, and classified them by Japanese nomenclature. The majority of these strains were mannitolfermenting, and only 5 of them were non-fermenting. Among mannitol-nonfermenting strains, the other characters were not described in detail, so that it is hard to know whether they were corresponding to Shigella dysenteriae 1 or not. One hundred and two strains belonged to Komagome B type, namely, Shigella flexneri 2a, and 31 strains belonged to Kawase type (Sh. flex. 3a). The details are as Table 1.

On the other hand, Wang, K. Y. and Liu had isolated 787 strains of Shigella from Chinese army during 1949 to 1952. According to the authors, 5 strains of them had characters of Shigella dysenteriae 1, and 2 of them were Schmitz type. The others, namely, 777 strains (98.7%) belonged to Komagome B type, namely, Shigella flexneri 2a, and 31 strains belonged to Kawase type (Sh. flex. 3a). The details is as table 2.

Types distribution of Shigella during 1951 - 1953 (Yang et al., 1950). They had collected 136

* Presented as part of a symposium "Salmonella and Shigella Types in East Asia" at the 37th General Meeting of Japan Bacteriological Society, Nagasaki, Japan, 2 April 1964, with Yoshio Aoki as convener.
Table 1. Results of WANG, S. P. et al. (1950)

<table>
<thead>
<tr>
<th>Place</th>
<th>Type</th>
<th>Komagome B</th>
<th>Kawase</th>
<th>Mannitol-nonfermenting</th>
<th>Komagome A</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keelung Hosp.</td>
<td></td>
<td>10</td>
<td>12</td>
<td></td>
<td>2</td>
<td>24</td>
</tr>
<tr>
<td>Taipei Hosp.</td>
<td></td>
<td>28</td>
<td>6</td>
<td></td>
<td>1</td>
<td>35</td>
</tr>
<tr>
<td>Railway Hosp.</td>
<td></td>
<td>15</td>
<td>5</td>
<td></td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>University Hosp.</td>
<td></td>
<td>35</td>
<td>5</td>
<td></td>
<td>1</td>
<td>41</td>
</tr>
<tr>
<td>Prov. Health Lab.</td>
<td>Taipei</td>
<td>8</td>
<td>3</td>
<td></td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Sinchu</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>102</td>
<td>31</td>
<td>5</td>
<td>2</td>
<td>140</td>
</tr>
</tbody>
</table>

Table 2. Results of WANG, K. Y. (1949 - 1952)

<table>
<thead>
<tr>
<th>Year</th>
<th>Strains</th>
<th>Sh. Shiga</th>
<th>Sh. Schmitt</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Subgroup A</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>1949</td>
<td>Sh. flexneri</td>
<td>107</td>
<td>1</td>
</tr>
<tr>
<td>1950</td>
<td>Sh. flexneri</td>
<td>498</td>
<td>4</td>
</tr>
<tr>
<td>1951</td>
<td>Sh. flexneri</td>
<td>97</td>
<td>0</td>
</tr>
<tr>
<td>1952</td>
<td>Sh. flexneri</td>
<td>85</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>Sh. flexneri</td>
<td>787</td>
<td>5</td>
</tr>
</tbody>
</table>

Shigella strains from National Taiwan University Hospital during 1951 - 1953, and classified them by international nomenclature with self-produced antisera. During this period, the main epidemic strains of Shigella were also Shigella flexneri, and only 5% of Shigella sonnei mixed in them. Shigella dysenteriae 1 has been no more detectable since this period and Shigella boydii has never reported in Taiwan.

Among Shigella flexneri subgroups, 2a and 3a occupied 31.61% and 19.11% of total Shigella strains. In the paper of YANG et al they reported 8 strains of Shigella flexneri 4c, but this type may be considered as variant of 4a, therefore, these strains are better referred to 4a. They also reported 21 strains of Shigella flexneri Y. Shigella flexneri Y can be isolated from patient too, but this strain can be considered as variant of Shigella flexneri 1a and 2a which lost their type antigens. From my personal experience, most Shigella flexneri Y may be classified as 1a or 2a by using proper reliable antisera. The report of YANG and others is summarized in Table 3.

**Type distribution of Shigella during 1956 to 1963.** Since 1956, we have collected Shigella strains in northern part of Taiwan, and classified them with antisera produced by Kitasato Institute and Difco Laboratories. Types distribution of Shigella during this period is almost the same as during the period of 1951 to 1953. Shigella flexneri subgroups are still the main cause of bacillary dysentery mixed with few strains of Shigella sonnei. Shigella dysenteriae and Shigella boydii were never isolated. Among Shigella flexneri, 2a and 3a were most oftenly encountered, 33.01% and 24.27%, respectively, while Shigella sonnei were met at 9.22% of total shigellosis. It is said that, Shigella flexneri 1b and 2b are rather common types of Shigella in Japan, but we have met
### Table 3. Shigella isolated in Taiwan

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subgroup A</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Sh. dysenteriae</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sh. flex.</td>
<td>1a</td>
<td>4</td>
<td>8</td>
<td>11</td>
<td>23</td>
<td>16,91</td>
<td>2</td>
<td>13</td>
<td>12</td>
<td>2</td>
<td>1</td>
<td>30</td>
<td>14,56</td>
<td>53</td>
</tr>
<tr>
<td>&quot;</td>
<td>1d</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>2a</td>
<td>12</td>
<td>19</td>
<td>10</td>
<td>41</td>
<td>30,14</td>
<td>11</td>
<td>26</td>
<td>15</td>
<td>1</td>
<td>15</td>
<td>68</td>
<td>33,00</td>
<td>109</td>
</tr>
<tr>
<td>&quot;</td>
<td>2b</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>3a</td>
<td>4</td>
<td>16</td>
<td>6</td>
<td>26</td>
<td>19,11</td>
<td>1</td>
<td>12</td>
<td>20</td>
<td>0</td>
<td>17</td>
<td>50</td>
<td>24,26</td>
<td>76</td>
</tr>
<tr>
<td>&quot;</td>
<td>3b</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>13</td>
<td>6,31</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>4a</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>9</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>16</td>
<td>7,76</td>
<td>19</td>
<td>5,55</td>
</tr>
<tr>
<td>&quot;</td>
<td>4b</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>4c</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>7</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Variant</strong></td>
<td>X</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>Y</td>
<td>12</td>
<td>6</td>
<td>3</td>
<td>21</td>
<td>15,44</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>21</td>
<td>6,14</td>
<td></td>
</tr>
<tr>
<td><strong>Subgroup B</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sh. doydii</td>
<td>1-7</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>3</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>19</td>
<td>9,22</td>
<td>26</td>
<td>7,60</td>
</tr>
<tr>
<td><strong>Subgroup D</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sh. sonnei</td>
<td>1-7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

* Dr. Yang  ** Dr. Hsu

*Shigella flexneri* 2b, and rarely met *Shigella flexneri* 1b during this period.

Since 1951, 342 strains of locally isolated Shigella were classified serologically by international nomenclature by Yang and his co-workers and us, and the results can be summarized in Table 3 and as follows:

During recent 10 years, epidemic strains of bacillary dysentery in Taiwan are almost *Shigella flexneri*. Among *Shigella flexneri*, types 2a, 3a and 1a are most frequently encountered, namely, 31.87%, 22.22% and 15.50%, respectively. Mannitol-nonfermenting strains of *Shigella flexneri* 4a, *Shigella flexneri* 5 and gas-producing strains of *Shigella flexneri* 6 are occasionally isolated.

Beside our reports, Wang, K. Y. (1962) has

### Table 4. Results of Wang, K. Y. (March 1961-Feb. 1962)

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Type</th>
<th>No. of strain</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td><em>Sh. dysenteriae</em></td>
<td>1-7</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td><em>Sh. flexneri</em></td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>B</td>
<td>&quot;</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>X,Y</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>C</td>
<td><em>Sh. doydii</em></td>
<td>1-7</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td><em>Sh. sonnei</em></td>
<td>10</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>untypable</td>
<td>4</td>
<td>8%</td>
</tr>
</tbody>
</table>
Shu-Tao Hsu, M. D.

reported types of 50 Shigella strains which were isolated from 389 diarrheal cases during March 1961 to Feb. 1962, using Lederle and Difco produced antisera. In this report, 36 strains were *Shigella flexneri*, namely, *Shigella flexneri* I (3 strains), *Sh. flex. 2a* (21 strains), *Sh. flex. 3* (9 strains), *Sh. flex. 4* (1 strain) and *Sh. flex. 5* (2 strains), The others 10 strains were *Shigella sonnei* and 4 strains were untypable (Table 4).

Although Alkalescens-Dispar group is already excluded from Shigella group, their biological characters resemble to Shigella. During 1960 to 1961 (Lee et al., 1961) 4 cases of Alkalescens-Dispar group were isolated, namely, 0-1 type (one strain), 0-2 type (two strains) and 0-5 type (one strain), and their pathogenicity was suspected because their population in stool were quite parallel with the course of enteritis.

**Drug Fastness**

It is a well-known fact that Shigella has tendency to acquire drug fastness with staphylococci and tubercle bacilli than other pathogens. Although increasing resistance of Shigella to drug has been reported here by several clinicians, their methods and criteria for testing fastness were not always the same, therefore, their results were hardly comparable with each other. In Taiwan, antibiotics and other drugs are easily procured and their prices are especially cheap. These factors may be useful for development of drug fastness of Shigella than other places.

**Fastness of Shigella to sulfa-drug**, Hsu, C. M. (1960) has reported that about 90% of Shigella here are resistant to 1000 mcg per ml of sulfadrugs. He has tested 79 strains isolated in 1960 by agar dilution method, and 92.4% were resistant to sulfisomidine (Table 5). He also commented the resistance of Shigella to other sulfadrug that the results were almost same as sulfisomidine.

**Fastness of Shigella to antibiotics.** Since 1955, increased resistance of Shigella to antibiotics were oftenly reported by clinicians. They mainly used paper disc method of different origin, some of them self-produced, the others, products of Difco, Showa, etc., for testing of sensitivities, therefore, concentrations of disc and criteria for resistant strain were different.

Disc method expresses resistance more qualitatively than quantitatively, nevertheless all reports agree that Shigella in Taiwan has high resistant ratio to antibiotics of streptomycin, tetracycline and chloramphenicol.

According to Hsu, J. W. and Cheng (1961) and Hsu, T. C. et al. (1960), about 70-80% of our Shigella strains were resistant to streptomycin (SM), tetracycline (TC) and chloramphenicol (CP), during 1955 to 1960. Yu and Wang (1962) collected 50 strains of Shigella in 1962 and they found that 90% of them were resistant to SM, TC and CP. These data are summarized in Table 6 and 7.

On the other hand, we have collected 133 strains of Shigella strains during 1956, 1960 and 1963, and tested their sensitivity to antibiotics, such as SM, TC, CP, kanamycin (KM), colistin (CO), and neomycin (NM), by agar dilution method (Hsu, S. T., Lin, C.H., Liao, C. L., and Tsai, J. L.). The strain which was capable to grow over 100 mcg per ml of antibiotics was regarded as resistant, but the strains were tested to the other concentrations of antibiotics

<table>
<thead>
<tr>
<th>Shigella</th>
<th>M I C (mcg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Flexner 1a</td>
<td></td>
</tr>
<tr>
<td>2a</td>
<td></td>
</tr>
<tr>
<td>3a</td>
<td></td>
</tr>
<tr>
<td>3b</td>
<td></td>
</tr>
<tr>
<td>4a</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Sonne</td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Minimal inhibiting concentration Shigella strains to sulfisomidine
### Table 6. Resistance of Shigella to antibiotics
(National Taiwan University Hospital; 1955-1961)

<table>
<thead>
<tr>
<th>Year</th>
<th>Antibiotics</th>
<th>Number of resistant strains</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SM</td>
</tr>
<tr>
<td></td>
<td>Concentration*</td>
<td>500</td>
</tr>
<tr>
<td>1955</td>
<td>- ±**</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>+ # #</td>
<td>4</td>
</tr>
<tr>
<td>1956</td>
<td>- ±</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>+ # #</td>
<td>2</td>
</tr>
<tr>
<td>1957</td>
<td>- ±</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>+ # #</td>
<td>4</td>
</tr>
<tr>
<td>1958</td>
<td>- ±</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>+ # #</td>
<td>2</td>
</tr>
<tr>
<td>1959</td>
<td>- ±</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>+ # #</td>
<td>0</td>
</tr>
<tr>
<td>1960</td>
<td>- ±</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>+ # #</td>
<td>4</td>
</tr>
<tr>
<td>1961</td>
<td>- ±</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>+ # #</td>
<td>4</td>
</tr>
</tbody>
</table>

* mcg per ml (SM, AM, TM and CM) or per disc (the others).
** Degree of inhibition.
AM—Chlortetacycline TM—Oxytetracycline.

### Table 7. Types of Shigella and drug fastness (1956-1963)

<table>
<thead>
<tr>
<th>Shigella</th>
<th>TC + SM + CP</th>
<th>TC + SM</th>
<th>SM + CP</th>
<th>CP + TC</th>
<th>TC only</th>
<th>SM only</th>
<th>CP only</th>
<th>Sensitive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sh. flex.</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>2a</td>
<td>32</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>47</td>
</tr>
<tr>
<td>2b</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>3a</td>
<td>16</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>24</td>
</tr>
<tr>
<td>3b</td>
<td>6</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>4a</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>4b</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Sh. sonnei</td>
<td>9</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>5</td>
<td>12</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>21</td>
<td>133</td>
</tr>
<tr>
<td>%</td>
<td>63.15</td>
<td>3.76</td>
<td>9.02</td>
<td>4.51</td>
<td>1.50</td>
<td>0.75</td>
<td>1.50</td>
<td>15.79</td>
<td></td>
</tr>
</tbody>
</table>
quantitatively.

In despite of the strains isolated in 1956 or 1963, they showed high resistant rates to SM, TC and CP, namely, $74.43 \pm 3.78\%$, $76.69 \pm 3.66\%$, and $78.193 \pm 58\%$, respectively. Among the resistant strains, triply resistant strains to SM, TC and CP were occupied most of them, and singly or dublely resistant strains were extremely few. The yearly changes of resistant strains were not distinct, because there were already too many resistant strains in 1956 and sample size was too small.

The distribution of resistant strains to antibiotics by types and their yearly changes are summarized in the Table 8. For kanamycin, colistine and neomycin, our Shigella strain seems to remain

<table>
<thead>
<tr>
<th>Table 8. Yearly changes of resistant strains</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antibiotics</strong></td>
</tr>
<tr>
<td>Sh. flex.</td>
</tr>
<tr>
<td>1a</td>
</tr>
<tr>
<td>2a</td>
</tr>
<tr>
<td>2b</td>
</tr>
<tr>
<td>3a</td>
</tr>
<tr>
<td>4a</td>
</tr>
<tr>
<td>4b</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>Sh. sonnei</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>%</td>
</tr>
<tr>
<td>Resistant ratio</td>
</tr>
</tbody>
</table>

Numerator: Number of resistant strains.
Denominator: Total strains.

**Fig. 1. Sensitivity of 50 Shigella strains to 12 antibiotics**
in sensitive state.

The quantitative sensitivities of 133 Shigella strains to antibiotics were demonstrated by histograms. The qualitative resistances of Shigella to different antibiotics are much differed each other by antibiotics. Sensitive and resistant

Fig. 2. Distribution of sensitivity of 133 Shigella strains to antibiotics

- **Streptomycin**
  - 100
  - 90
  - 80
  - 70
  - 60
  - 50
  - 40
  - 30
  - 20
  - 10
  - 10%

- **Tetracycline**
  - 100
  - 90
  - 80
  - 70
  - 60
  - 50
  - 40
  - 30
  - 20
  - 10
  - 10%

- **Chloramphenicol**
  - 100
  - 90
  - 80
  - 70
  - 60
  - 50
  - 40
  - 30
  - 20
  - 10
  - 10%

- **Kanamycin**
  - 100
  - 90
  - 80
  - 70
  - 60
  - 50
  - 40
  - 30
  - 20
  - 10
  - 10%

- **Colistin**
  - 100
  - 90
  - 80
  - 70
  - 60
  - 50
  - 40
  - 30
  - 20
  - 10
  - 10%

- **Neomycin**
  - 100
  - 90
  - 80
  - 70
  - 60
  - 50
  - 40
  - 30
  - 20
  - 10
  - 10%

MIC in Micrograms (Colistin - in Units)
strains are sharply separated in case of SM and TC, but this tendency is less in CP, KM, NM and CO. Shigella showed very clear sensitive curves as Figure 2.

**Sensitivity of Shigella to nitrofuran derivatives.** To furazolidone, we have tested 121 strains of Shigella in 1960 (Hsu S. T.), and the result showed that Shigella was sensitive to furazolidone. Resistant strain of Shigella to this new compound is not yet demonstrated here. Detail is shown in Figure 3. (Co-workers: Chung-Ho Liu, Chi-Lieh LTAO, and Ju-Lan Tsai).

---

**References**


Received for publication June 19, 1964