

## Salmonellosis in Indonesia: phage type distribution of *Salmonella paratyphi A*\*

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### SUMMARY

The distribution of phage types among 221 human strains of *Salmonella paratyphi A* in Indonesia was studied. Approximately 50% were phage type 5, a rare type elsewhere in the world. Most other isolates were the cosmopolitan phage type 1. The ratio of phage type 1-5 was compared for two cities on Java, Jakarta and Yogyakarta. The ratios were significantly different, phage type 5 predominating in Jakarta. The ratio of phage types among 10 *S. paratyphi A* strains isolated from Jakarta river water was similar to that found in Jakarta patients.

### INTRODUCTION

Enteric fever caused by *Salmonella typhi*, *S. paratyphi A*, and other salmonellae continues to be a major public health problem for developing countries. Phage typing of salmonellae from these countries is a valuable tool for distinguishing

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Table 1. *Phage type distribution of Salmonella paratyphi A isolated from human sources in Indonesia*

Geographic source	Strains tested	Phage type						Non-typable	De-graded strains
		1	2	3	4	5	6		
Jakarta (urban)	114	37	—	—	—	74	—	—	3
Jakarta (suburban-rural)	45	16	1	—	—	27	—	1	—
Yogyakarta (Central Java)	57	46	—	—	1	7	—	1	2
Other areas of Indonesia	5	2	—	—	—	2	—	1	—
Total	221	101	1	0	1	110	0	3	5

specific strains, tracing epidemic sources, and defining potential problems (Anderson & Williams, 1956; Cragie & Felix, 1947). While phage type distribution of the more predominant *S. typhi* has been extensively studied in many parts of the world, that of *S. paratyphi A* has received less attention.

Distribution of *S. paratyphi A* phage types in Indonesia has been reported previously only once (Felix, 1955). This present study was designed to define *S. paratyphi A* phage type distribution in selected areas of Indonesia more thoroughly.

#### MATERIALS AND METHODS

Of the 231 *S. paratyphi A* strains received during the period beginning 1974 through mid-1976, 219 were from acute cases of enteric fever, 2 were from carriers, and 10 cultures were isolated from the rivers flowing through Jakarta. There were 159 human source strains from the Jakarta area, primarily from three hospitals drawing patients from the northern, western, and central areas of the city. A fourth hospital located in Cilandak, a suburb to the south, provided 45 cultures. This hospital drew its patients from both the surrounding suburban area and the rural area still further south and inland. Four cultures were obtained from expatriates living in Jakarta. Yogyakarta, a major city in central Java, was the source of 57 cultures, and 5 were obtained from other areas in central Java, northern Sumatra and northern Sulawesi.

The method described by Banker, 1955, was used for phage typing, and nutrient agar was the plating medium.

#### RESULTS

The phage type distribution of *S. paratyphi A* cultures isolated from human sources appears in Table 1. Four phage types were found, plus non-typable and degraded strains. The predominant types were 1 and 5. In urban Jakarta and suburban-rural Jakarta-Cilandak, type 5 predominated by a ratio of approximately 2:1. In Yogyakarta, the reverse was true, phage type 1 predominating by more than 6:1. The minor distribution differences between urban and suburban-rural Jakarta were not statistically significant, but when these were compared with the phage type distribution in Yogyakarta, the difference was highly significant ( $P < 0.0001$ ).

Among the Jakarta cultures were four from expatriates living in Jakarta. These include three of phage type 5 and one phage type 1.

Ten isolates were obtained from Jakarta river water. Their phage type distribution was similar to that among Jakarta patients; six strains of phage type 5, three of phage type 1, and one untypable strain.

#### DISCUSSION

The most notable finding was the high proportion of phage type 5. In the most recent report of the International Committee for Enteric Phage-Typing, only one area reported phage type 5, 0.34% of strains in New Delhi (Nicolle & Anderson, 1973). By contrast, 49.8% of our strains were phage type 5. This would seem to indicate that phage type 5 may be restricted to certain areas in Indonesia. Such a conclusion must be tempered with caution, however, since other parts of southeast Asia have been poorly represented in the international reports.

It is important to consider the comparative geography of countries like Indonesia when considering phage type distribution. Indonesia is a large country consisting of more than 3000 islands. It might be misleading to assume that phage type distribution could be the same throughout Indonesia. Further knowledge of the geographic range of phage type 5 must await extension of survey studies to cities of Sumatra, Kalimantan, and Sulawesi. It will also be necessary to learn more about the phage type distribution in Malaysia, Singapore, Thailand, Vietnam, and the Philippines before firm conclusions can be made about the true geographic distribution of the rare phage type 5.

The data demonstrate that highly significant differences in phage type distribution can occur even on a single island, in this case Java. The ratios of phage type 1 to phage type 5 are 1:2 for Jakarta but more than 6:1 for Yogyakarta. Evidently geographic, cultural, or other barriers may be sufficient to restrict general distribution of specific bacterial strains, even within a populous and physically confined geographic area. Thus, the rare phage type 5 might be peculiar to a limited area such as Jakarta, with peripheral spread to Yogyakarta and Sumatra. However, other ecological factors might be involved.

Other phage types such as 2, 4, and 6, common in areas of the Middle East, Europe, and Japan are rare or non-existent in this study. Thus, it would seem that contacts with the Middle East through Islam have not brought phage type 2 to Java, and similarly, the more recent Japanese influence apparently did not introduce phage type 4, which is commonly found in Japan.

Cultures from expatriates in Jakarta were predominantly the more common phage type found there, as might be expected. Jakarta may not have been the source of the other expatriate infection, phage type 1, since this individual travelled extensively.

In conclusion, the epidemiology of *S. paratyphi A* in Indonesia shows several characteristics:

- (1) A high frequency of phage type 5, possibly limited in geographic distribution within Indonesia.
- (2) No resistance to antibiotics commonly used clinically.

(3) Almost complete absence of phage types 2, 4, and 6 which are encountered in other countries of southeastern Asia.

Further studies of significant numbers of strains collected from other areas of Indonesia may prove very valuable in elucidating ecologic factors contributing to *S. paratyphi A* distribution.

Although the number of *S. paratyphi A* strains isolated from the river in Jakarta was small, these still provided an accurate reflexion of the proportion of phage types present in the community. Thus, from an epidemiological viewpoint, river sampling could be considered a useful test in an epidemiologic survey for *S. paratyphi A* phage types.

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