India Papers > Medicine - Veterinary > Veterinary colleges and laboratories > Indian journal of veterinary science and animal husbandry > Volumes 26-27, 1956-1957

[Note: Pages 51 to 102 are missing from volume 26]

From: (410) Page 79

To: (415) Page 84

(Note: Blank pages will not be included in this PDF file.)

NOTE ON THE OCCURRENCE OF ATYPICAL STRAINS OF FOOT-AND-MOUTH DISEASE VIRUS IN INDIA*

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A scheme of research financed by the Indian Council of Agricultural Research, is being operated at the Indian Veterinary Research Institute, Mukteswar, with the object of devising a suitable method of vaccination for the control of foot-and-mouth disease among cattle in India. The disease is widespread in this country and causes substantial loss to the cultivators. It is caused by three distinct immunological types of the virus known as Vallee "O" and "A" and Waldmann "C".

A number of outbreaks of the disease caused by one or the other of these types occur annually in various parts of the country but the clinical manifestation in the affected animals is the same for all the types. As the types of the virus are immunologically distinct from one another, any attempt at vaccination as a measure of control of the disease should necessarily contain the representative types that cause the epizootics. In order to have an idea of the frequency and distribution of the occurrence of the different types, fresh material was obtained from natural outbreaks in the fields and typed by cross immunity test in guinea pigs. In the course of type determination, variants of the three standard types of the virus have been observed to cause outbreaks in this country [Seetharaman and Dutt, 1951]. The occurrence of atypical strains of foot-and-mouth disease virus is of interest and, therefore, is recorded in this article. An analysis of the results of typing of 72 field strains of the virus isolated from different parts of India, showing the frequency distribution of the various types is given in Table I

Atypical strains

The first atypical strain was isolated from the material collected from a buffalo in an outbreak at Rawalpindi (Punjab), and sent to the Institute in April, 1944. After adaptation of the strain of virus to guinea pigs, cross immunity tests were carried out to determine the type. It was found to be quite distinct from the standard types as it broke immunity against all of them, each of which in turn broke immunity against it. Its behaviour continued to remain unaltered after 61 guinea pig passages.

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TABLE I

Distribution of various types of foot-and-mouth disease virus in India

Place of origin State	Types						
	'O'	'O' variant	'A'	'A' variant	'C'	'C' variant	Atypical
Andhra Pradesh	1	1	..	..	..	..	..
Assam	..	1	..	..	..	..	..
Bengal	..	..	..	..	..	1	..
Bihar	..	1	..	..	..	..	..
Bombay	1	1	..	1	..	..	..
Himachal Pradesh	1	..	..	..	..	..	..
Jammu and Kashmir	..	1	..	..	..	..	..
Madhya Pradesh	..	..	..	1	..	1	..
Madras	..	..	..	1	1	..	..
Orissa	1	1	..	1	..	..	..
Punjab	1	..	..	3	..	..	..
Uttar Pradesh	17	9	5	9	1	2	3
Areas now in Pakistan	2	1	..	..	..	1	1
Total	24	16	5	16	2	5	4
Percentage	33·3	22·2	7·0	22·2	2·8	7·0	5·5

Two strains were obtained from natural outbreaks at the Indian Veterinary Research Institute, Izatnagar in May, 1951. Izatnagar is about 1000 miles south-east of Rawalpindi area. Material was collected from fresh cases at the Izatnagar Dairy as well as from animals of the Animal Nutrition Division. These two strains were found atypical, breaking immunity against the standard types. However, they were immunologically identical.

Again there was an outbreak of the disease among cattle of the Animal Nutrition Division, Izatnagar in April, 1952. Fresh material was collected and this strain also proved to be atypical and immunologically identical with the Izatnagar strain of 1951.

These Izatnagar strains have each undergone more than a dozen guinea-pig passages. They maintain their immunological character.

A noteworthy observation in regard to the atypical strains in general is their easy and rapid adaptability to guinea pigs. From the second passage they are adapted to guinea pigs, showing the characteristic primary lesions followed by generalization.

Cross-immunity test

All the cross-immunity tests were carried out in guinea pigs. First, guinea pigs immune to standard type "O", " A " and " C " (Pirbright) and those against other atypical strains were tested with the Rawalpindi atypical strain (Table II). Then guinea pigs immune to Rawalpindi strain of virus were tested with standard types " O ", " A " and " C " (Table III). Again, Izatnagar Dairy atypical strain was given to immune guinea pigs of all the strains (Table IV). Similarly, the guinea pigs immune to all the strains under experiment were tested with Izatnagar Animal Nutrition Division atypical strain (TableV).

The observation of the tests were :

(1) Each atypical strain evidently had homologous immunity.

(2) All the atypical strains broke immunity against the three standard types, each of which in turn broke immunity against the atypical strains.

(3) The three Izatnagar atypical strains were immunologically identical.

(4) Rawalpindi atypical strain was immunologically distinct from the Izatnagar atypical strain.

Discussion

The occurrence of the three standard types and their variants causing outbreak of the disease has been observed in this country.

Apparently atypical strains, immunologically distinct from one another caused repeated outbreaks of the disease at Izatnagar causing difficulties for the control of foot-and-mouth disease by vaccination. It has been shown that variants of the same type have different antigenic structures and the antigenic properties in turn vary from strain to strain [Ubertini, 1951]. A recent epizootic in Europe was characterised by the spontaneous appearance of variants of the virus [Ramon, 1952] and vaccines failed to control the spread of infection due to the presence of variants of type, antigenically different from one another [Lancet, 1952]. I t is generally believed that variants and perhaps atypical strains are heterologous composites derived for the standard types. When the question of control by vaccination of the epizootic caused by variants of types is so unsatisfactory, the control of the disease caused by atypical strains would be more complicated.

Note : Since this article was sent out for publication, the Rawalpindi strain, the Izatnagar 51 and 52 strains were sent to the Virus Research Institute, Pirbright (England) for confirmation of the findings. The atypical character of the Izatnagar strains has been confirmed by the workers at Pirbright, whereas in respect of the Rawalpindi strain it was reported to correspond to classical type 'O' virus. On scrutiny of the record of the Rawalpindi strain, it was found that it was typed last at this Institute at guinea pig passage No. 58 and was atypical in character beyond any doubt. The material despatched to Pirbright was from guinea pig passage No. 74 . Since the chances for the cross contamination of the virus while being handled in the laboratory are considered very remote, it appears, that the virus changed in its antigenic character somewhere between passage No. 58 and 74 by shedding off its heterologous components and reverted to the type 'O' virus.

The atypical Izatnagar strain has since been designated as Asia I.

TABLE II

Cross immunity test with Rawalpindi atypical strain of virus

Guinea pig No.	Immune to type	Interval between immunisation and test (days)	Days:	1	2	3	4	5	6	7	8
			Date:	22	23	24	25	26	27	28	29
120	Pirbright "A"	53		+0	++	++	++	++	++	++	
121	do.	53		+0	++	++	++	++	++	++	
102	Pirbright "O"	58		+0	++	++	++	++	++	++	
103	do.	58		+0	++	++	++	++	++	++	
126	Pirbrigh "C"	52		+0	++	++	++	++	++	++	
127	do.	52		+0	++	++	++	++	++	++	
153	I. S. Izat., A.N.S.	47		+0	++	++	++	++	++	++	
180	do.	38		+0	++	++	++	++	++	++	
146	I.S. Izat., Dairy	48		+0	++	++	++	++	++	++	
147	do.	48		+0	++	++	++	++	++	++	
160	I.S. 19 Rawalpindi	44		00	00	00	00	00	00	00	
161	do.	44		00	00	00	00	00	00	00	

Note: (1) The guinea pigs were tested on June 22, 1952 with I. S. 19 Rawalpindi strain collected from guinea pigs on June 9, 1952.
(2) 00, + 0 and ++ represent "no reaction", "local reaction" and "local reaction plus generalisation" respectively.

TABLE III

Cross immunity with standard type "O", "A" and "C" virus of guinea pigs immunised against I.S. 19 Rawalpindi strain

Guinea pig No.	Interval between immunisation and test (days)	Tested with strain	Reaction after test. Days:	1	2	3	4	5	6	7	8
			Date:	14	15	16	17	18	19	20	
296	33	Pirbright "A"		+0	+0	+0	+0	++	++	++	++
302	38	do.		+0	+0	+0	++	++	++	++	++
304	35	Pirbright "O"		+0	+0	++	++	++	++	++	++
305	35	do.		+0	+0	++	++	++	++	++	++
303	34	Pirbright "C"		+0	+0	++	++	++	++	++	++

Note: +0 and ++ represent "local reaction" and "local reaction plus generalisation," respectively.

TABLE IV

Cross immunity test with Izatnagar Dairy atypical strain of virus

Guinea pig No.	Immune to type	Interval between immunisation and test (days)	Reaction after test. Days:	1	2	3	4	5	6	7	8
			Date:	19	20	21	22	23	24	25	26
118	Pribright "A"	50		+0	+0	++	++				
119	do.	50		+0	+0	++	++				
100	Pirbright "O"	56		+0	+0	++	++				
101	do.	56		+0	+0	++	++				
124	Pirbright "C"	49		+0	+0	++	++				
125	do.	49		+0	+0	++	++				
158	I.S. 19 Rawalpindi	41		+0	+0	++	++				
159	do.	41		+0	+0	++	++				
151	I.S. Izat. A.N.S.	44		00	00	00	00				
152	do.	44		00	00	00	00				
144	I.S. Izat. Diary	45		00	00	00	00				
145	do.	45		00	00	00	00				

Notes: (1) The guinea pigs were tested on June 19, 1952 with I.S. Izat. Dairy strain collected from guinea pigs on June 14, 1952

(2) 00, +0 and ++ represent "no reaction," "local reaction" and "local reaction plus generalisation", respectively.

TABLE V

Cross immunity test with I.S. Izatnagar A.N.S. atypical strain of virus

Guinea pig No.	Immune to type	Interval between immunisation and test (days)	Days:	1	2	3	4	5	6	7	8
			Date:	16	17	18	19	20	21	22	23
116	Pirbright "A"	47		+0	+0	+0	++	++	++		
117	do.	47		+0	+0	++	++	++	++		
98	Pirbright "O"	53		+0	+0	++	++	++	++		
99	do.	53		+0	+0	+0	++	++	++		
122	Pirbright "C"	46		+0	+0	+0	++	++	++		
123	do.	46		+0	+0	++	++	++	++		
156	I.S. 19 Rawalpindi strain	38		+0	+0	++	++	++	++		
157	do.	38		+0	+0	++	++	++	++		
142	I.S. Izatnagar Diary strain	42		00	00	00	00	00	00		
143	do.	42		00	00	00	00	00	00		
148	I.S. Izatnagar A.N.S. strain	41		00	00	00	00	00	00		
149	do.	41		00	00	00	00	00	0		

Notes: (1) The guinea pigs were tested on June 16, 1952 with I.S Izatnagar A.N.S. strain collected from guinea pigs on June 15, 1952

(2) 00, +0 and ++ represent "no reaction" "local reaction" and "local reaction + generalisation", respectively.

SUMMARY

An analysis of the results of typing of 72 strains of foot and-mouth Disease virus isolated from different parts of India shows that the frequency distribution of the various types is as follows:

Vallee "O" 24 "O"	Variant	16	55·6 per cent
Vallee "A" 5 "A"	Variant	16	29·1 per cent
Waldmann "C" 2 "C"	Variant	5	9·7 per cent
Atypical 4	——	——	9·6 per cent

Variants of the three types of the virus Vallee "O", and "A" and Waldmann "C" have been observed to occur in various parts of the country. The occurrence of four atypical strains of Foot-and-Mouth Disease virus is recorded. A noteworthy feature is the occurrence of immunologically identical atypical strains causing repeated outbreaks of the disease. However, the atypical strains obtained from Izatnagar were found to be immunologically distinct from the atypical strain from Rawalpindi, nearly a thousand miles away.

REFERENCES

Lancet (1952). Annotations—*Foot-and-Mouth Disease*. **262**, 299

Ramon, G. (1952). Bull. Off. internat. Epiz. *37*, 102 (*ab. Vet. Bull.* **22**, 624)

Seetharaman, C. and Dutt, N. S. (1951) *Indian J. vet. Sci.* **21**, 251

Ubertini, B. (1951). Bull. Off. internat. Epiz. *35*, 627. (*abstr. Vet. Bull.* **22**, 626)