Studies with Bovine Parainfluenza – 3 Virus in U.A.R. (Egypt)*

by K. V. Singh and Ivon F El Cicy

ABSTRACT

A bovine strain of myxovirus parainfluenza-3 (MP3) virus, designated S virus, was isolated from lung tissue collected from cattle with respiratory illness in 1963. The virus agglutinates mammalian and avian erythrocytes, and is sensitive to ether, sodium desoxycholate and trypsin. It grows in primary calf kidney, buffalo kidney, dog kidney, camel kidney and MS cell cultures. The S virus forms well-defined plaques in buffalo and calf kidney cells on the 5th or 6th day after inoculation. Examination of cell cultures following inoculation with S virus revealed giant cell formation, and intracytoplasmic and intranuclear inclusions. At 37°C the virus titer dropped from $10^{10.4}$ to $10^{2.6}$ in 3 days. Virus was completely inactivated at 56°C within 15 minutes. Growth-curve studies in tissue culture monolayer cells revealed a latent period of 10 hours. The intracellular virus titer was slightly lower than that of extracellular virus. The isolate was identified as MP3 virus by serum neutralization and hemagglutination-inhibition tests. Antibodies (HI) to S virus were shown to be present in a significant proportion of Egyptian cattle. The epidemiological significance of MP3 (bovine strain) virus in U.A.R. is discussed.

A sound knowledge of the etiology and natural history of respiratory diseases of cattle is of paramount importance for their eventual effective control. However very little is known regarding the viral etiology of some of the respiratory infections of cattle in the Middle East. Respiratory disease morbidity in cattle, particularly in U.A.R. (Egypt) remains one of the major unsolved problems of veterinary preventive medicine.

In recent years, with improved available techniques, a number of viral agents have been isolated from the nasal secretions of cattle with clinical manifestations of respiratory infection (1, 2, 3, 4, 5, 6, 7). Myxo-virus parainfluenza-3 (MP3) virus has been associated with shipping fever in U.S.A. (1), a mucosal-disease-like syndrome in Sweden (8), calf pneumonia in Germany (9) and acute respiratory illness in Japan (10). We failed to find published evidence regarding the isolation of para-influenza-3 virus from cattle in U.A.R. The purpose of this report is to describe the properties of MP3 virus, designated as S strain, isolated in our laboratory in December 1963 from sick Somali cattle at the Suez quarantine station and to present serological evidence of MP3 infection in U.A.R.

Materials and Methods

Herd history. In December 1963 a respiratory disease characterized by coughing, dyspnea and mucopurulent nasal discharge appeared at the Suez quarantine station among beef cattle imported from Somalia. Rectal temperatures of sick cattle ranged from 103° to 107°F. Response of the herd to broad spectrum antibiotics had not been satisfactory. A post-mortem examination of dead cattle showed patchy consolidation of ventral portions of the lungs. The tracheal mucosa was congested and covered by a mucopurulent exudate. No other significant post-mortem changes were seen in any other tissues.

Collection of specimens. Nasal mucus was collected by inserting a sterile cotton swab applicator into each nostril and then washing it thoroughly in 2 ml. of Hank's balanced salt solution (HBSS) containing 1000 units of penicillin, 500 ug of streptomycin, 500 units of nystatin and 500 ug of kenamycin sulphate per milliliter. The

*From the Rinderpest Research Laboratories of the Near East Animal Health Institute, P.O. Box 2223, Cairo, U.A.R. Supported jointly by the Ministry of Agriculture, U.A.R. and the United Nations Development Program.

resulting suspension was centrifuged at 3000 r.p.m. at 10°C for 30 minutes in an angle centrifuge. The supernatant fluid was then harvested and stored at —25°C until tested. Pieces of affected lung tissue were collected aseptically and an approximately 10 per cent suspension in the HBSS was made in a Ten Broeck grinder. The suspension was centrifuged as described previously and supernatant fluid was stored frozen until tested. Blood samples from sick cattle showing 40°C or higher temperature were collected for virus isolation, into separate screw-cap bottles containing heparin at a final concentration of 20 i.u. per ml. and stored at —25°C until tested.

Tissue culture. Primary monolayer tissue cultures were prepared by trypsinization as described by Hancock, Bohl and Birkeland (11). Dispersed cells were suspended in a medium consisting of: 0.5 per cent lactalbumin hydrolysate (LAH), 3.0 to 5.0 per cent calf serum in HBSS with 100 units of penicillin, 50 ug of streptomycin, 50 units of nystatin and 50 ug of kenamycin sulphate per milliliter. After 6 to 8 days the cultures were confluent and were used.

Subcultures of MS (monkey stable) cells kindly supplied by Dr. Y. Ozawa of the Near East Animal Health Institute, Teheran, were prepared in growth medium. Cell suspensions were prepared by adding 0.25 per cent trypsin solution in HBSS to monolayers.

Virus isolation. For virus isolation, 0.2 ml. of each of the specimens was inoculated into each of four primary bovine kidney culture tubes and examined microscopically every day for the appearance of cytopathic effect (CPE). When almost the entire monolayer had degenerated, fluids were harvested and frozen at —25°C. Three blind passages were made with each specimen before it was considered negative.

Plaque assay. Monolayer cultures of bovine kidney cells in 4-oz. prescription bottles were prepared and used as described previously (12). Virus dilutions were prepared in HBSS. The fluid medium was discarded from the bottles and 0.2 ml. of each virus dilution was inoculated into each of two bottles. After one hour adsorption of the virus onto the monolayer at 37°C, 10 milliliter of agar overlay medium was poured into each bottle. The agar overlay was composed of 100 ml. of HBSS (without phenol red), 0.5 grams lactalbumin hydrolysate, 1.2 grams noble agar (Difco) 3 ml. bovine serum and 1.0 ml. of 1:1000 dilution of neutral red. The pH of the overlay medium was adjusted to 7.5 by 4.4 per cent sodium bicarbonate. The bottles were inverted after the agar medium hardened and incubated at 37°C for 10 days. Plaques were examined and counted daily for 10 days. Infectivity titers were expressed as PFU/ml.

Infectivity titrations in tubes were performed by inoculating 0.2 ml. of 10-fold dilutions of virus suspension into each of 4 tubes per dilution. Cultures were incubated at 37°C and examined daily for 12 days. Infectivity end points as TCD_{50} were calculated by the method of Reed and Muench (13).

Isolation of pure line of virus. Since a single plaque, in most cases, arises from a single infective virus particle, isolated virus was purified as previously described (12). A plaque-isolated strain of virus, in the form of infective tissue culture fluid containing 3 per cent bovine serum was used throughout this study.

Preparation of antiserum. Adult rabbits weighing 1 to 1.5 kilograms were used for the production of antiserum. On the first day each rabbit was injected intramuscularly with 10 ml. of virus adjuvant mixture (equal parts of infected culture fluid and Bacto complete adjuvant — Difco). At weekly intervals 1 ml. of the virus (infected tissue culture fluid) was inoculated intravenously. The rabbits were bled 8 weeks after the first inoculation when the neutralizing antibody titer was the highest as determined by the titers of test bleedings.

Known hyperimmune antisera prepared in susceptible calves from bovine parainfluenza-3 virus and infectious bovine rhinotracheitis (IBR) virus were kindly supplied by Dr. A. H. Hamdy and Dr. E. H. Bohl of the Ohio Agricultural Experimental Station, Wooster, Ohio, U.S.A.

Ether sensitivity. Two ml. of stock virus suspension in a screw-capped test tube was prewarmed in a water bath at 37°C and 0.8 ml. of diethyl ether was added. The tube was tightly stoppered and agitated. It was incubated at 37°C for ½ hour and then centrifuged at 2000 r.p.m. for 10 minutes to separate the ether from the aqueous layer. The aqueous layer was assayed for virus infectivity by plaque tech-

nique. A virus control tube containing HBSS instead of ether was handled in a similar manner.

Sodium desoxycholate sensitivity. A 1-in-500 solution of sodium desoxycholate prepared in phosphate buffered saline was sterilized by filtration. Equal amounts of undiluted virus and sodium desoxycholate dilution were mixed together. The mixture was shaken, allowed to stand for 4 hours at 4°C, and then titrated. A control tube which contained HBSS instead of sodium desoxycholate was treated in a similar manner.

Trypsin sensitivity. One per cent Seitz filtered trypsin (Difco 1:300) solution in HBSS was added in equal amounts to ten times diluted infected culture fluid. The mixture was shaken and stored for 1 hour at 37°C and normal calf serum in a proportion of 1 to 4 was added to inactivate the trypsin with virus being diluted to 10^{-2}. Infectivity of the trypsin-virus mixture along with a similarly treated virus control was determined by the plaque technique.

Thermal inactivation. Sterile screw-capped vials were preheated in a water bath and 1 ml. of virus as infected tissue culture fluid was added to a series of vials which were stirred to bring the temperature up to the desired level. At various times a vial was removed, immediately cooled in ice water, and stored with the 0 time sample at —25°C. Virus assays were done by the plaque technique within 10 days of storage.

Effect of freezing and thawing. Infected tissue culture fluid was centrifuged at 1000 r.p.m. for 10 minutes and 1 ml. aliquots were distributed in screw capped vials. The vials were frozen at —25°C, and thawed by placing the vials in a water bath at 37°C. This was repeated four times and each time one vial was removed and stored frozen for virus titration.

Serum neutralization test. The plaque reduction method was used for carrying out serum neutralization tests. Based on a prior titration of the stock, virus at a concentration of 100 PFU per 0.1 ml. was mixed with an equal volume of serum at varying dilutions and the mixtures were incubated at 25°C for 1 hour. The virus-serum mixture in a volume of 0.2 ml. was then seeded on drained calf kidney monolayers. After adsorption at 37°C for 1 hour, the cultures were overlaid with agar medium. The dilution of serum that neutralized 90 per cent of the PFU was taken as the end point.

Hemagglutination test. Red cells of various animal species were washed three times with normal saline solution (NSS) and stored at 4°C as a 1 per cent suspension in NSS. Plate hemagglutination tests were carried out by adding 0.4 ml. of the red cell suspension to equal volumes of serial two-fold dilutions of virus stock and incubating at 4°C. Tissue culture fluid from uninoculated bovine kidney cell culture tubes was utilized as a control. Readings were made when the patterns were evident in controls.

Hemadsorption test. This test was carried out according to the technique described by Vogel and Shelokov (14). Tubes infected with virus were emptied of the infected fluid and then 0.2 ml. of a 0.25 per cent guinea pig erythrocyte suspension was added to the tubes. After incubation for 2 minutes at room temperature cultures were washed once with HBSS and observed microscopically for clumping of erythrocytes.

Hemagglutination inhibition test. Serial 2- to 4- fold dilutions of heat-inactivated serum were made in plates so that each well had 0.2 ml. of the respective dilution. An equal volume of virus dilution containing 4 hemagglutinating (HA) units was added to each well. After one hour's incubation at 4°C 0.4 ml. of a 1 per cent guinea pig erythrocyte suspension was added to each well. Tests were read when patterns were clear in control tubes. The titer of the serum was the last dilution completely inhibiting hemagglutination. All serum samples were inactivated at 56°C for 30 minutes.

Cytological changes. Cultures of calf kidney, camel kidney, buffalo kidney, dog kidney and MS cells were grown on coverslips in Leighton tubes. At appropriate intervals the cover slips were fixed with Zenker's fixative and stained with hematoxylin eosin stain as described by Reissig, Howes, and Melnick (15).

Rate of adsorption. To determine the rate of adsorption of S virus, a series of monolayer cultures was inoculated with 0.2 ml. of diluted virus giving approximately 100 PFU per bottle. The infected cells were incubated at 37°C. At various intervals three bottles were taken out of the incuba-

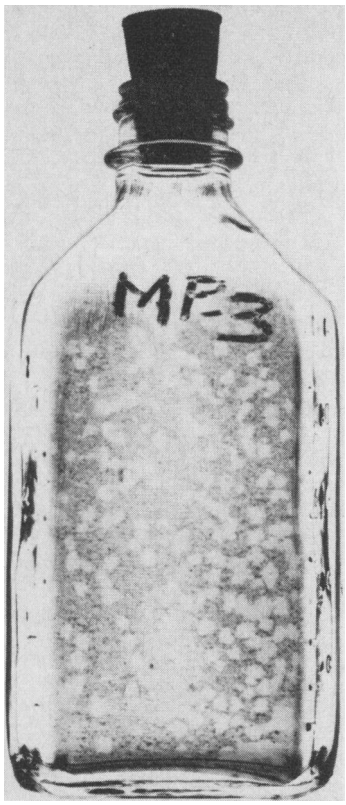

Fig. 1. Plaques of S virus in bovine kidney cells on seventh day of incubation.

tor, washed four times with 10 ml. of HBSS and then overlaid with overlay medium. Plaque counts were made on the 7th and 10th days after inoculation.

Growth curve. Four-oz, prescription bottles with a monolayer culture containing approximately 2 x 10^6 cells were inoculated with 1 ml. of virus containing 2 x 10^6 PFU. Cell counts were determined from duplicate bottles with a counting chamber. After 2 hours of incubation at 37°C the cell layer was washed four times, each time with 10 ml. of HBSS, to remove free virus. Each washing was assayed to determine the virus removed. Ten milliliters of lactalbumin hydrolysate medium (LAHM) containing 3 per cent bovine serum was added to each bottle and they were further incubated at 37°C. At each time interval, three bottles were harvested as follows:

(a) *Free virus.* Pooled fluids were centrifuged at 2000 r.p.m. for 5 minutes and the supernatant was frozen at —25°C for later titration.

(b) *Cell-Associated virus.* Each of the three bottles was washed once with 10 ml. HBSS, and then the monolayer was removed by 0.02 per cent Versene in Ca: Mg-free HBSS. After dispersal, cells were pooled, deposited by centrifugation at 1000 r.p.m. for 5 minutes and resuspended in 30 ml. of maintenance medium. This suspension was frozen and thawed 4 times and then clarified by centrifugation for 5 minutes at 3000 r.p.m. The supernatant was regarded as being cell-associated virus and stored at —25°C until titrated.

Results

Isolation. The virus, designated S strain, was isolated in primary bovine kidney cells from the lung tissue obtained at the time of postmortem examination of a sick cattle showing coughing, dyspnea, thick nasal discharge and a fever of 105°F. On postmortem examination the ventral halves of the lungs were found to be congested and the apical lobe showed patchy consolidation. The mucosa of the trachea was severely congested. No significant gross pathological changes were detected in any other tissues.

The cytopathic effect (CPE) observed ten days after inoculation of tissue cultures was the focal rounding of the cells. On

TABLE I. Inactivation effect of diethyl ether, sodium desoxycholate and trypsin upon S virus

Chemical	Time of exposure	Temperature of exposure	Control virus titer/ml.	Treated virus titer/ml.	Log inactivation.
Sodium desoxycholate 1:500 dilution	4 hours	4 C	$10^{9.1}$	0	9.1
Diethyle ether	½ hour	37 C	$10^{5.7}$	0	5.7
Trypsin (1:300) 1 per cent solution.	1 hour	37 C	$10^{7.2}$	$<10^2$	>5.2

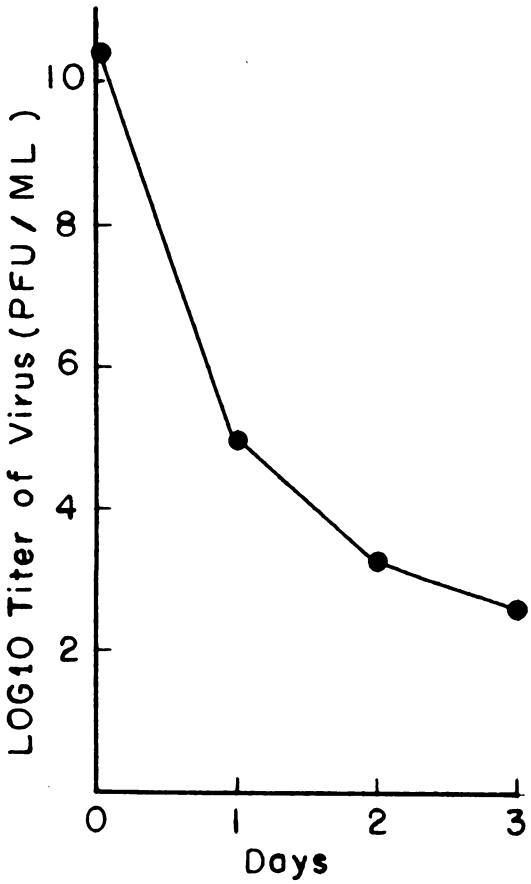

Fig. 2. Inactivation of infectivity of S virus at 37 C.

the subsequent two passages CPE became more pronounced and was observed within 48 to 72 hours. Cytopathic change consisted of few round refractile cells with small and large syncitia formation. On further incubation the cells detached from the glass.

Plaque characteristics. The plaques produced by S virus were small and clear with an irregular border (fig. 1). They appeared on the 5th or 6th day after inoculation and attained a size of 3 to 5 millimeters in 8 days.

Effect of ether. No infectivity could be detected in the tissue culture fluid containing S virus following treatment with diethyl ether (Table I).

Effect of sodium desoxycholate. The virus was inactivated by sodium desoxycholate, (Table I).

Effect of trypsin. The S virus is sensitive to 1 per cent trypsis (1:300 Difco), (Table I).

Thermal inactivation. The rate of inactivation of the infectivity of S virus at 37°C in lactalbumin hydrolysate medium with 3 per cent bovine serum at pH 7.4, was determined by the plaque assay method. Each point in figure 2 represents the mean of two separate experiments. In three days S virus titer dropped from $10^{10.4}$ to $10^{2.6}$ PFU per milliliter. The half-life at 37°C is approximately 3.0 hours. The S virus was inactivated at 56°C within 15 minutes (fig. 3), and with a half-life at 56°C of approximately 27 seconds. It seems that S virus suspended in LAHM with 3 per cent bovine serum was relatively stable at 37°C and lost its infectivity at 56°C in 15 minutes.

Effect of freezing and thawing. After 4 cycles of freezing and thawing no appreciable change in HA and infectivity titers was noted (Table II) indicating that S virus in LAHM with 3 per cent bovine serum was resistant to the effect of freezing and thawing indicating that a

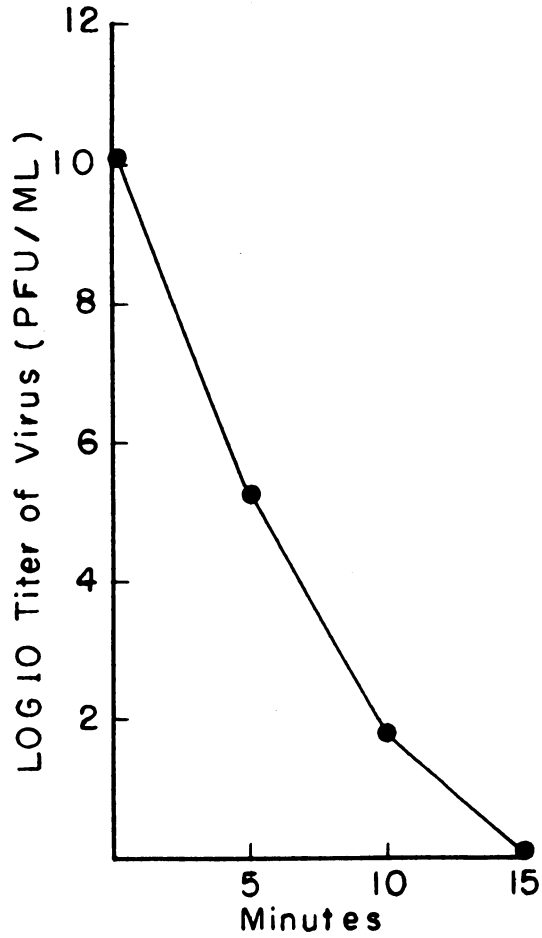

Fig. 3. Inactivation of infectivity of S virus at 56 C.

TABLE II. Effect of freezing and thawing on plaque formation and haemagglutinins of S virus

Number* of experiment	Number of times frozen and thawed	Log^{10}titer (PFU/0.2 ml.) of virus	HA titer**
1	0	9.1	64
	1	9.3	64
	2	9.2	64
	3	9.0	64
	4	9.1	64
2	0	6.2	32
	1	6.4	32
	2	6.0	32
	4	6.3	32

*These two experiments were done with two different pools of virus

**HA titers were expressed as the reciprocal of last dilution of 0.4 ml. of virus giving complete haemagglutination with 0.4 ml. of 1 per cent chicken erythrocytes.

TABLE III. Haemagglutination of erythrocytes of various species of animals by S virus

Animal R.B.Cs.	Virus dilutions. 1:4	1:8	1:16	1:32	1:64	1:128	1:256	1:512	Cell control
Chicken	4+	4+	3+	3+	2+	+	−	−	−
Guinea-pig	4+	4+	4+	4+	3+	+	−	−	−
Sheep	4+	4+	4+	4+	2+	−	−	−	−
Cattle	4+	4+	4+	4+	3+	±	−	−	−
Rabbit	4+	4+	4+	4+	4+	3+	3+	−	−
Horse	−	−	−	−	−	−	−	−	−

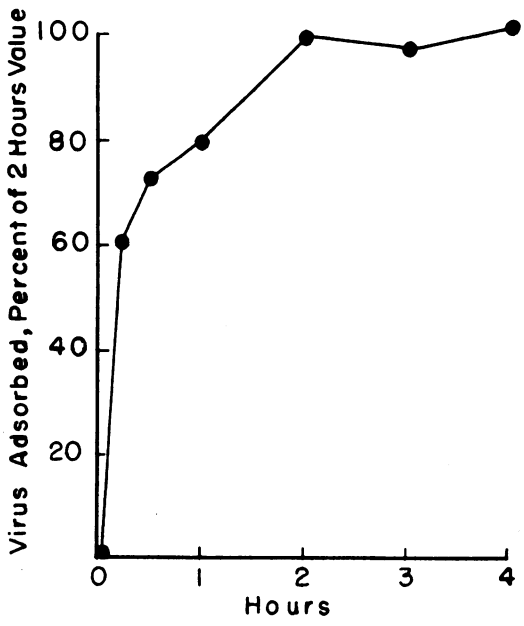

Fig. 4. Rate of adsorption of S virus to bovine kidney cells at 37 C.

vial of virus pool can be used after freezing and thawing a few times.

Hemagglutination: As shown in Table III the virus caused hemagglutination of chicken, cattle, sheep and guinea pig erythrocytes at 4°C. Chicken and guinea pig erythrocytes were agglutinated equally well. The majority of HI tests were conducted with guinea-pig erythrocytes at 4°C.

Hemadsorption was detected in infected cultures when tested either with guinea pig or chicken erythrocytes.

Identification of S Virus. The biological and physical properties observed suggest that the isolate identified as S might be a myxovirus. It was, therefore, tested against bovine parainfluenza-3 virus, infectious bovine rhinotracheitis (IBR), and rinderpest antisera. The isolate is not neutralized by either rinderpest or IBR antisera whereas a 1:1024 dilution of parainfluenza antiserum inhibited 90 per cent of 100 PFU of S virus (Table IV). thus indicating that the isolate is related to parainfluenza-3 virus of bovine origin.

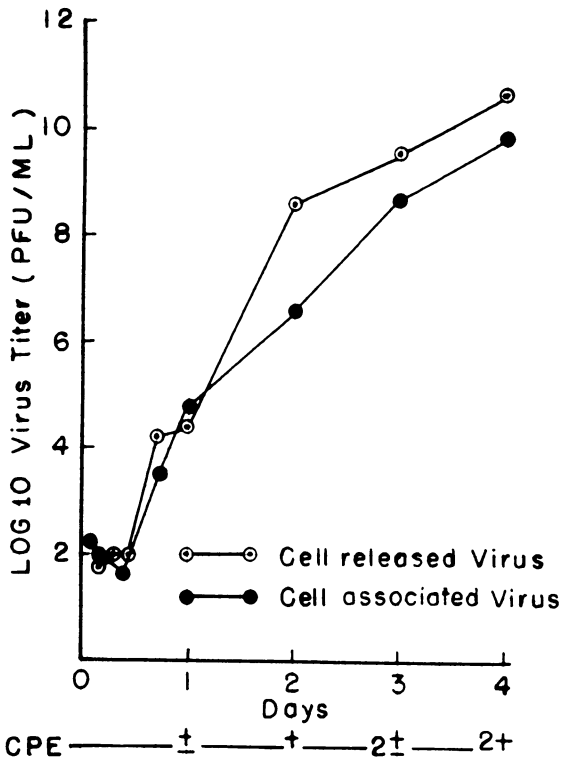

Fig. 5. The growth of S virus in bovine kidney cells.

Rate of adsorption. The adsorption of the virus to primary calf kidney cells was relatively rapid. Approximately 61 per cent of the PFUs were adsorbed within 15 minutes and within 1 hour of incubation at 37°C 80 per cent adsorption occurred (fig. 4) One hour was selected as the adsorption period for plaque titration of S virus.

Growth curve. Very little virus was detected in the first 10 hours after inoculation. There was a rise in the cell-released (CR) and cell-associated (CA) virus from the 10th to the 18th hour. On the 4th day the CR virus titer reached $10^{10.6}$ and that of the CA virus $10^{9.8}$ PFU per milliliter (fig. 5), cytopathic effect was first observed 1 day after inoculation and on the 4th day approximately 50 to 60 per cent of the cells showed degenerative changes.

These resuls indicated that there was an exponential rise in titer following a 10-hour latent period. Cytopathic effect was not a true indication of the release of virus in fluid medium. The titers of free virus and of intracellular virue were similar.

Cytopathologys:

(a) *Bovine kidney cell cultures.* Cytoplasmic inclusions and giant cell formation were noticed on the 2nd day following inoculation. Cytoplasmic inclusions increased in size and number until the 6th day. At times a single large inclusion filled the whole cytoplasm. Intranuclear eosinophilic inclusions were first noticed on the 4th day. There were from 1 to 5 spherical inclusions per nucleus. The intracytoplasmic and intranuclear inclusions were surrounded by a clear halo (fig. 6).

(b) *Camel kidney cultures.* S virus produced distinct large eosinophilic intranuclear and intracytoplasmic inclusions in primary camel kidney cells (fig. 7) Intracytoplasmic inclusions were first observed 2 days after infection. Giant cell formation and cytoplasmic inclusions were present on the 2nd day. No distinct visible cytopathic changes were noticed 10

TABLE IV. Neutralization tests with S virus against various serum samples

Type of serum sample	Animal No.	Immunization	SN titer	HI titer
Anti-bovine para-*influenza-3 serum	Calf No. 220	Pre Post	0 1:1024	0 1:2048
Anti IBR serum*	Cow No. 914	Pre Post	0 0	
Anti S serum**	Rabbit No. 64	Pre Post	0 1:1000	1:1024
Anti-rinderpest** serum	buffalo	Pre Post	1:10 1:10	

*Serum samples were obtained from Dr. A. H. Hamdy and Dr. E.H. Bohl, Ohio Agricultural Experimental Station, Wooster, Ohio, U.S.A.x

**Antisera were prepared in this laboratory.

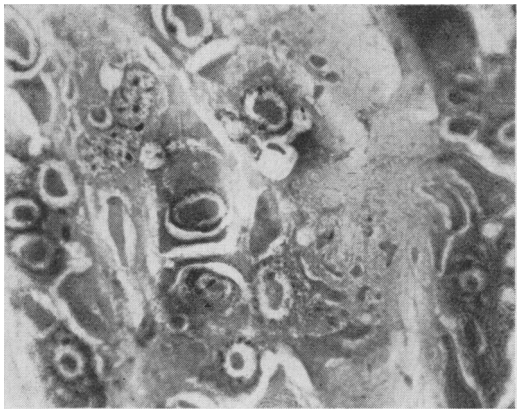

Fig. 6. Calf kidney cells 7 days after inoculation with S virus. Note giant cells, large eosinophilic cytoplasmic and intranuclear inclusions. Zenker's hematoxyline and eosin: X532.3.

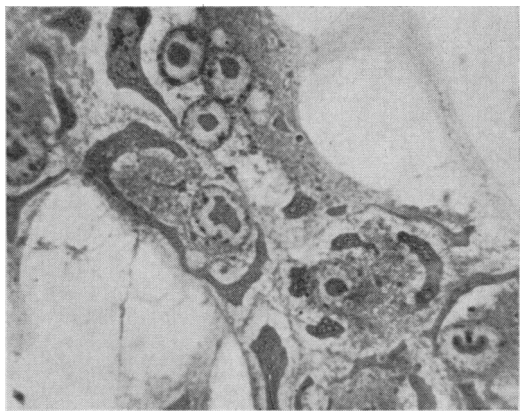

Fig. 7. Eosinophilic cytoplasmic and intranuclear inclusions in camel kidney cells infected with S virus. Zenker's, hematoxylin and eosin: X532.3.

days after inoculation. No inclusions were present in normal control cultures (fig. 8).

(c) *Dog kidney cultures.* Almost 100 per cent of the cells showed cytoplasmic inclusions 2 days after inoculation with S virus. Giant cell formation was noticed regularly (fig. 9). Approximately 11 to 14 per cent of the cells showed intranuclear inclusions. No visible CPE was noticed in infected cultures up to the 12th day.

(d) *MS cells.* S virus produced distinct cytoplasmic inclusion and vacuoles in MS cell cultures. Giant cells containing up to 30 nuclei were formed. Cytoplasmic inclusion and giant cells were observed 3 days after inoculation and by the 8th day approximately 80% of the cells showed cytoplasmic as well as intranuclear inclusions (fig. 10).

Incidence of bovine parainfluenza-3 virus in U.A.R. Serum samples collected from cattle in different parts of the U.A.R. were tested by the HI test. A titer of 1-in-64 or higher was taken as an indication of infection (16). Tests revealed the presence of HI antibodies (16-100 per cent) in serum samples collected from different localities (Table V).

Discussion

The isolation and characterizaton of S virus beef from cattle imported from Somalia into U.A.R. in 1963 have been described. The infectivity of the virus was destroyed by ether, sodium desoxycholate and trypsin. Virus agglutinated mammalian and avian erythrocytes at 4°C and produced hemadsorption with chicken and guinea pig erythrocytes. Cultured cells showed giant cell formation and produced eosinophilic, cytoplasmic and intranuclear inclusions, following infection with S virus. These properties are similar to those of the myxovirus para-influenza group (17) suggesting that the S virus belongs to this group. Serological identification confirmed that the isolate was antigenically related

TABLE V. Distribution of H.I. antibodies to S virus in Egypt

Province	No of serum samples tested	No of serum samples having antibodies	Percentage of positive samples
Sharkia	16	8	50
Kaliobia	11	6	54.4
Monofia	10	10	100
Raffah	17	17	100
Damanhour	75	12	16
Assiout	18	9	50
Sakkha	16	16	100
Fayoum	10	10	100
Total	**173**	**88**	**50.8**

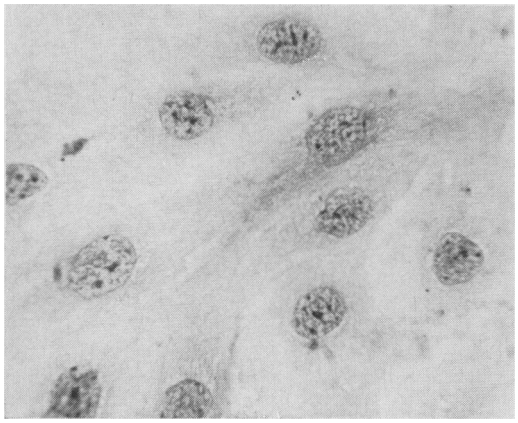

Fig. 8. Normal noninoculated camel kidney cells. Zenker's, hematoxylin and eosin: X532.3.

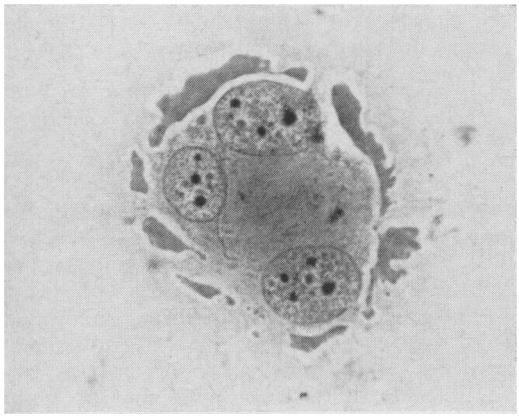

Fig. 9. Giant cell formation and intracytoplasmic and small intranuclear inclusions in primary dog kidney cells 8 days after inoculation with S virus. Zenkers hematoxyline and eosin: X532.3.

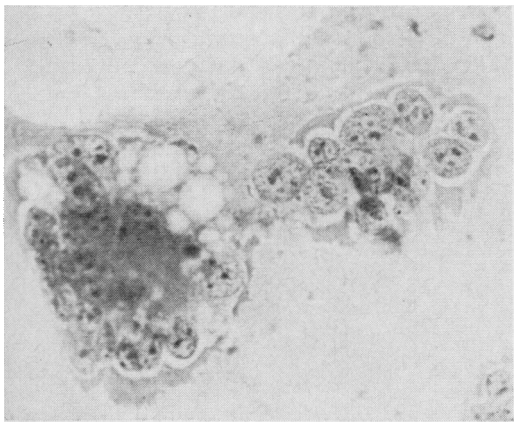

Fig. 10. M.S. cells 8 days after inoculation with S virus. Giant cells and eosinnophilic intranuclear and intracytoplasmic inclusions are present. Zenker's, hematoxylin and eosin: X290.6.

to the MP3 virus of bovine origin.

Japanese workers (10) have described large and small types of plaques produced by parainfluenza-3 virus isolated from nasal swabs taken from cattle with acute respiratory illness. The S virus produced only small types of plaques. Comparative thermal inactivation studies with different bovine strains of MP3 virus might prove to be useful in identifying these isolates. However thermal stability studies would vary until and unless they are done with a cloned virus population under rigid control of physio-chemical factors in the medium.

Cytopathic effect studies revealed that S virus produced severe cellular changes in the mammalian cell cultures which were similar to those recorded by Dawson in bovine kidney and Hela cell cultures by T_1 strain of virus (18) and by Churchill for bovine parainfluenza-3 virus in monkey kidney and Hep. 2 cells (19). It is of interest to note that distinct cytoplasmic and intranuclear inclusions developed in infected primary camel kidney cell cultures without producing visible CPE, indicating that S virus can multiply in camel kidney cells without destroying the cell.

The results of a preliminary serological survey of cattle in the U.A.R. (Egypt) suggests the presence of a high percentage of animals showing HI antibodies against the virus. Since no vaccination against this virus was practised at the time of this survey, the results indicate a high percentage of exposure in certain provinces of U.A.R. The exact role played by parainfluenza virus in the etiology of clinical bovine respiratory illness in U.A.R. has still to be determined, but serological evidence presented in this report indicates that S virus is one of the viral agents involved in respiratory diseases of cattle. The pathogenic potentialities, especially the association of MP3 (bovine strain) with shipping fever have been reported by various workers (1,3,20,21). Infection of a 4½ week old colostrum-deprived calf with MP3 virus resulted in aseptic pneumonia (22). Stress has been reported to produce a more severe clinical reaction than infection with virus alone (20,23).

Since MP3 (Umea 33) virus has been associated with symptoms of mucosal disease (8), it is an important factor in the differential diagnosis of rinderpest and rinderpest-like diseases in U.A.R.

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Dr. Ephrem Jacques

Jacques directeur à l'Ecole de Médecine Vétérinaire de St-Hyacinthe

Le Dr Ephrem Jacques, m.v., vient d'être nommé directeur à l'Ecole de Médecine vétérinaire de Saint-Hyacinthe affiliée à l'Université de Montréal. Il succède au Dr Joseph Dufresne, qui a résigné ses fonctions. Le Dr Jacques a été nommé professeur à l'Ecole en 1957 puis il devint par la suite directeur-adjoint et directeur de l'extension de l'enseignement vétérinaire. Né à Southbridge, Massachusetts en 1916, le Dr Jacques a fait ses études classiques au Collège l'Assomption où il obtint son B.A. en 1938 et son doctorat en médecine vétérinaire de l'Université de Montréal en 1942. Avant son accession au professorat, il exerçait à Richmond, Québec.