Virus Name: Main Drain		Abbreviation: MDV
Status **Arbovirus**	Select Agent **No**	SALS Level **2**

SALS Basis
Results of SALS surveys and information from the Catalogue.

Other Information

Antigenic Group
Bunyamwera

SECTION I - Full Virus Name and Prototype Number

Prototype Strain Number / Designation	Accession Number	Original Date Submitted
BFS 5015		7/24/1984

Family	Genus
Bunyaviridae	**Bunyavirus**

Information From	Address
Robert P. Scrivani	**School of Public Health, University of California, Berkeley, California, USA**

Information Footnote
Revised

Section II - Original Source

Isolated By (name)	Isolated at Institute	
Robert P. Scrivani	**School of Public Health, Berkeley**	
Host Genus **Culicoides variipennis (pool of 100)**	Species	Host Age/Stage **Adult**

Sex
Female

Isolated From	Isolation Details
Signs and Symptoms of Illness	Arthropod
Time Held Alive before Inoculation	
Collection Method **Dry ice baited trap**	Collection Date **5/27/1964**

Place Collected (Minimum of City, State, Country)
Kern County, California, USA

Latitude	Longitude
35° 30' N	**119° 0' W**

Macrohabitat	Microhabitat	Method of Storage until Inoculated
Semi-desert, saltbush vegetation bordering agricultural land	**Outdoors, ground level**	**Sealed glass tube at -65dC**

Footnotes

Section III - Method of Isolation

Inoculation Date
3/10/1965

Animal (Details will be in Section 6)
nb mice (Tissue Culture)

Route Inoculated
Intracerebral

Reisolation
Yes

Other Reasons
No similar virus in laboratory

Homologous Antibody Formation by Source Animal

Test(s) Used

Footnotes

Section IV - Virus Properties

Physicochemical
RNA, Single Strand

Pieces (number of genome segments)
3

Infectivity

Sedimentation Coefficients(s)
(S)

Percentage wt, of Virion Protein

Lipid

Carbohydrate

Virion Polypeptides: Number
3 (2)

Details
Determined by polyacrylamide gel electrophoresis (2)

Non-virion Polypeptides: Number

Details

Virion Density

Sedimentation Coefficients(s)
(S)

Nucleocapsid Density

Sedimentation Coefficients(s)
(S)

Stability of Infectivity (effects)

pH (infective range)

Lipid Solvent (ether - % used to test)

After Treatment Titer

Control Titer

Lipid Solvent (chloroform)

After Treatment Titer

Control Titer

Lipid Solvent (deoxycholate)
1:1000

After Treatment Titer
<2.0 dex

Control Titer
5.5 dex

Other (formalin, radiation)

Virion Morphology

Shape

Dimensions

Mean
nm

Range
nm

Measurement Method

Surface Projections/Envelope

Nucleocapsid Dimensions, Symmetry

Morphogenesis

Site of Constituent Formation in Cell	Site of Virion Assembly	Site of Virion Accumulation
Inclusion Bodies	Other	

Hemagglutination

Hemaggiutination	Antigen Source	Erythrocytes (species used)
Yes	**SMB ext. by sucrose-acetone**	**Goose**
pH Range	pH Optimum	
6.1-6.4	**6.2**	
Temperature Range	Temperature Optimum	
4dC, 22dC, 37dC	**37dC**	

Remarks
Low titer HA (from 20-40) enhanced by sonication to 160-320

Serologic Methods Recommended
HI, NT, CF

Footnotes
Low titer HA (from 20-40) enhanced by sonication to 160-320

Section V - Antigenic Relationship and Lack of Relationship to Other Viruses

See Reference [6] .

Type of ImmuneFluid	Immune Fluid or Antigen	Main Drain Antigen CF [1] Ht/Ho [3]	Main Drain Antigen HI [1] Ht/Ho	Main Drain Antigen NT [2] Ht/Ho	Main Drain antiserum CF [1]	Main Drain antiserum HI [1]	Main Drain antiserum NT [2]
Hyperimmune mouse serum or ascitic fluid [4]	Main Drain	128	1280	2.1	128	1280	2.1
Cache Valley	16/64	0/80		64	0		
Lokern	256/512	0/640	0.0/3.7	64	0	0.3	
Maguari	32/64	0/320		64	0		
Tensaw	256/512	0/1280		64	0		
Tlacotalpan	512/512	10/320		64	10		
Immune hamster serum	Main Drain		80	2.5		80	2.5
Cache Valley		0/80	0.1/2.1		0	0.0	
Lokern		0/160	0.0/3.8		0	0.0	
Maguari		0/160	0.2/1.8		0	0.1	
Tensaw		10/640	1.2/2.0		0	0.0	

[1] CF and HI titers are expressed as the reciprocal of the serum or ascitic fluid dilution.

[2] NT results are expressed as LNI given in dex. Tests with hyperimmune sera or ascitic fluids were performed in SM inoculated ic, whereas tests with immune hamster serum were done by plaque reduction in Vero cells.

[3] Heterologous titer/homologous titer

[4] Reagents and facilities of the Yale Arbovirus Research Unit, New Haven, Connecticut, were made available through the courtesy of Dr. W.G. Downs and Dr. R.E. Shope for conducting HI tests. CF tests were done by Dr. R.E. Shope.

Section VI - Biologic Characteristics

Virus Source (all VERTEBRATE isolates)
Blood (LV), CNS (M)

Lab Methods of Virus Recovery (ALL ISOLATIONS)
Newborn mice

Cell system (a)	Virus passage history (b)	Evidence of Infection							
		CPE			PLAQUES			Growth Without CPE	
		Day (c)	Extent (d)	Titer TCD50/ml (e)	Day (c)	Size (f)	Titer PFU/ml (e)	+/- (g)	
Hamster kidney (PC)	SM 2	3	4+	8.6*					
Duck embryo (PC)	SM 5				3	Plaques			
Vero (CL)	SM 2	3-4	3-4+		3	Plaques	8.5*		
Ae dorsalis (CL)			No CPE					+ (3)	
Culex tarsalis (CL)			No CPE					+ (4)	

* Expressed in dex

Section VII - Natural Host Range (Additional text can be added below table)

Vertebrate (species and organ) and arthropod	No. isolations/No. tested	No. with antibody/No. tested Test used	Country and region
Man		0/269* HI	California, USA
Equine (brain)	1		Sacramento County, California, USA (7)
Lepus californicus	10/1,066	270/769 HI	Kern Co., CA, USA
Sylviagus auduboni	0/601	2/57 HI	
Ammospermophilus nelsoni	0/1,308	1/193 HI	
Citellus beecheyi	0/230	3/120 HI	
Sciurus griseus		1/35 HI	California, USA

Neotoma sp.		5/103 HI	
Other rodentia, chiroptera, carnivora	0/4,489	0/182 HI	
Wild birds		0/492 HI	Kern County, CA, USA
Amphibians/ reptiles	0/470	0/790 HI	
Equine		292/735 HI	California, USA
Bovine		11/519 HI	
Ovine		122/670 HI	
Porcine		1/84 HI	
Culicoides variipennis	29/122,089		Kern Co., CA, USA
Culex tarsalis	0/158,446		Butte, Glenn and Kern Co., CA, USA
Culicoides variipennis	2		Western Utah USA (8)
Psorophora signipennis	20		
Aedes dorsalis	9		
Ae. nigromaculis	3		
Culiseta inornata	1		
Other mosquitoes	0/58,974		Butte, Glenn and Kern Co., CA, USA
Other Culicoides spp., Leptoconops, Phlebotomus, Simulium, spp	0/11,689		California, USA

Paired sera from patients with undiagnosed febrile disease 1967-1969, supplied through the courtesy of Dr. E. Lennette, and Dr. R. Emmons, California State Department of Public Health.

Section VIII - Susceptibility to Experimental Infection (include viremia)

Experimental host and age	Passage history and strain	Inoculation Route-Dose	Evidence of infection	AST (days)	Titer log10/ml
Mice (nb)	SM 2	ic 0.01	Death	3	9.6
Mice (nb)		ip			
Mice (nb)		sc			
Mice (wn)		ic 0.03	Death	4	
Mice (wn)	SM 3	ip 0.10	Antibody		
L. californicus(ad)	100 PFU, SM 2	sc 0.20	Antibody and/or viremia		2.0-6.3
S. auduboni (ad)		sc 0.20	Antibody and/or viremia		2.1-5.1
A. nelsoni (ad)		sc 0.20	Antibody and/or viremia		2.7
D. nitratoides (ad)		sc 0.20	Antibody and/or viremia		2.4-6.3
Wild birds(finches, sparrows) chickens(3 wk)	750 PFU, SM 2	sc 0.20	No HI antibody		

Section IX - Experimental Arthropod Infection and Transmission

Arthropod species & virus source(a)	Method of Infection log10/ml (b)		Incubation period (c)		Transmision by bite (d)		Assay of arthropod, log10/ml (e)		
	Feeding	Injected	Days	°C	Host	Ratio	Whole	Organ	System
Culiseta inornata, Culex tarsalis, Anopheles freeborni, Ae melanimon, Ae nigromaculis, and Culicoides variipennis became infected after feeding on virus-soaked pledgets. Viremic S. auduboni served to infect Culiseta inornata, Anopheles freeborni and Culicoides variipennis but not Cx tarsalis, Dermacentor parumapertus or Ornithodorus parkeri. Infected Culicoides variipennis transmitted to S. auduboni, but infected Anopheles freeborni did not. Cuilcoides nubeculosus infected after intrathoracic inoculation and after ingestion. Transmission to mouse blood contained in chick skin membrane demonstrated after 16 days incubation at 26C (5).									

Section X - Histopathology

Character of lesions (specify host)

Inclusion Bodies — Intranuclear

Organs/Tissues Affected

Category of tropism

Section XI - Human Disease

In Nature — Residual — Death

Subclinical — Overt Disease

Clinical Manifestations

Number of Cases — Category (i.e. febrile illness, etc.)

Section XII - Geographic Distribution

Known (Virus detected)
California; Utah, USA (8)

Suspected (Antibody only detected)

Section XIII - References

1. Porterfield, J.S., et al. 1975/76. Intervirology. 6:13-24.
2. Gentsch, J., et al. 1977. J. Gen. Virol. 34:257-268.
3. Cahoon, B.E., et al. 1979. J. Med. Ent. 16:104-111.
4. Main, O.M., et al. 1977. J. Med. Ent. 14:107-112.
5. Mellor, P.S., et al. 1974. Arch ges. Virusforsch. 46:105-110.
6. Hunt, A.R. and Calisher, C.H. 1979. Am. J. Trop. Med. Hyg. 28:740-749.
7. Emmons, R.W., et al. 1983. J. Am. Vet. Med. Assoc. 183:555-558.
8. Crane, G.T., et al. 1983. J. Med. Ent. 20:294-300.

Remarks

Diagnostic HI antibody rise shown in paired sera from five cases of equine encephalomyelitis that had onsets in 1967, 1968 and 1969. Diagnostic rises were shown in three of the five cases by CF.