| Virus Name: Chikungunya | Abbreviation: CHIKV |
|---|---|

Status
**Arbovirus**

Select Agent
**No**

SALS Level
**3**

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

Other Information
**DOC Permit Required, Hepa Filtration, Vaccination Recommended**

Antigenic Group
**A**

## SECTION I - Full Virus Name and Prototype Number

Prototype Strain Number / Designation
**S 27**

Accession Number

Original Date Submitted
2/3/1985

Family
**Togaviridae**

Genus
**Alphavirus**

Information From
**J.P. Woodall**

Address
**YARU, Yale University School of Medicine, New Haven, Connecticut, 06510, USAR.**

Information Footnote
**Reviewed by editor**

## Section II - Original Source

Isolated By (name)
**W. Ross (1)**

Isolated at Institute
**Entebbe, Uganda**

Host Genus
**Man**

Species

Host Age/Stage

Sex
**Female**

| Isolated From | Isolation Details |
|---|---|
| **Serum/Plasma** | |

Signs and Symptoms of Illness
**Fever, joint pains**

Arthropod

Time Held Alive before Inoculation

Collection Method
**Venepuncture with vacuum venule**

Collection Date
**2/22/1953**

Place Collected (Minimum of City, State, Country)
**Liteho, Newala district, Tanzania**

Latitude
**10° 13' S**

Longitude
**39° 30' E**

Macrohabitat
**Cultivated plateau 2000 ft. A.S.L.**

Microhabitat
**Rural community**

Method of Storage until Inoculated
**On water ice**

Footnotes

## Section III - Method of Isolation

Inoculation Date
**2/22/1953**

Animal (Details will be in Section 6)
**wn mice**

Route Inoculated
**Intracerebral**

Reisolation
**Yes**

Other Reasons

Homologous Antibody Formation by Source Animal
**Yes**

Test(s) Used
**NT**

Footnotes

## Section IV - Virus Properties

Physicochemical
**RNA**

| | | |
|---|---|---|
| Pieces (number of genome segments) | Infectivity | Sedimentation Coefficients (s) (S) |
| Percentage wt, of Virion Protein | Lipid | Carbohydrate |
| Virion Polypeptides: Number | Details | |
| 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) **1:1** | After Treatment Titer **3.3 dex** | Control Titer **7.1 dex** |
| Lipid Solvent (chloroform) | After Treatment Titer | Control Titer |
| Lipid Solvent (deoxycholate) | After Treatment Titer | Control Titer |

Other (formalin, radiation)
**Unaffected by glycerine**

### Virion Morphology

| | | |
|---|---|---|
| Shape | Dimensions **42 - 59 nm** | |
| Mean nm | Range nm | |
| Measurement Method **Electron microscopy (17)** | Surface Projections/Envelope | Nucleocapsid Dimensions, Symmetry |

Electron Microscopy (17) | 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; serum ext. by sucrose-acetone + prot.,fluorocarbon14); acetone-ether** | **Goose** |
| pH Range | pH Optimum | |
| **5.8-6.3** | **5.9-6.2** | |
| Temperature Range | Temperature Optimum | |
| | **37dC** | |

Remarks
**Low passage antiserum inhibits both high and low passage HA antigens, buthigh passage antiserum is not as good against low+(12-14) as against high(>170) passage antigen (26). Autointerference occurs (1); good interferon producer and interf. Sens.**

Serologic Methods Recommended
**HI, CF, NT, plaque-inhibition**

Footnotes
**Low passage antiserum inhibits both high and low passage HA antigens, buthigh passage antiserum is not as good against low+(12-14) as against high(>170) passage antigen (26). Autointerference occurs (1); good interferon producer and interf. Sens.**

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

| | Chikungunya Antigen | | | | | Chikungunya Immune Serum | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HI | | CF | | NT | HI | | CF | | NT |
| | Ht/HO | Ratio | Ht/Ho | Ratio | ic | Ht/Ho | Ratio | Ht/Ho | Ratio | ic |
| ONN | 20/2560 | 1/128 | <8/128 | >1/16 | 2.5* | 160/320 | 1/2 | 64/256 | 1/4 | 4.4* |
| Mayaro | 160/5120 | 1/32 | 8/32 | 1/4 | 2.2 | 80/2560 | 1/32 | 16/128 | 1/8 | 2.7 |
| Semliki | 40/5120 | 1/128 | <4/256 | >1/64 | 1.4 | <10/2560 | >1/256 | 16/128 | 1/8 | 2.0* |
| WEE | 12/3870 | 1/320 | <4/128 | >1/32 | 0.6 | 16/2080 | 1/130 | <4/128 | >1/32 | |
| EEE | 15/5490 | 1/360 | <4/512 | >1/128 | 0.4 | 7/2080 | 1/300 | <4/128 | >1/32 | |
| VEE | 14/4780 | 1/340 | <4/512 | >1/128 | 0.8 | 7/2080 | 1/300 | <4/128 | >1/32 | |
| Sindbis | 8/968 | 1/120 | <4/256 | >1/64 | 0 | 8/2080 | 1/300 | <4/128 | >1/32 | <1.8* |
| AMM2021 | 20/10240 | 1/512 | 8/256 | 1/32 | | 49/2080 | 1/42 | <4/128 | >1/32 | <1.3* |

* NT done with the Th-35 strain (Thailand); NT results given as LNI in dex.

All immune sera were prepared in mice by repeated inoculations.

African strains appear to be antigenically more primitive than Asian strains [26] and can be clearly distinguished.

Plaque inhibition tests show (a) chikungunya and o'nyong-nyong can be distinguished only by using single-inoculation mouse antisera, not multiple- inoc. mouse, or rabbit, (b) African and Asian strains of chikungunya are not separable using mouse antisera only, (c) Semliki Forest antiserum inhibits chikungunya plaques, but not vice versa.
SIRACA has antigenically classified chikungunya virus and placed it in the Semliki Forest complex of serogroup A. In addition, ONN virus has been classified as a subtype of chikungunya virus [14] . For additional information on antigenic relationships, see References [17] , [39] - [42] .

## Section VI - Biologic Characteristics

Virus Source (all VERTEBRATE isolates)
**Blood (M), liver (LV)**

Lab Methods of Virus Recovery (ALL ISOLATIONS)
**Newborn and weanling mice and primates**

| 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) | |
| | | | | | | | | | |

HeLa (CL): CPE (18); mouse (PC), duck (PC) and chick embryo (PC): Plaques or CPE (22); Ae aegypti, Ae w-albus, Ae vittatus, An stephensi, Ae albopictus and Cx quinquefasciatus lines: multiplication (36); Drosophila line: multiplication (33). Vero (CL)and LLC-MK2 (CL): plaques (37).

## 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 | 12/29 | | Tanzania (1, 4); Uganda (5, 6) |
| Man | | 79/357 NT | E. Africa (1, 4, 6) |
| Man | | up to 37.5% | Mozambique (14) |
| Man | 1 | 32/508 NT | S. Africa (8, 12) |
| Man | 2 | 60/242 NT | Congo (Leo) (21) |
| Man | 1 | | S. Zimbabwe |
| Man | 56 | | Nigeria (32) |
| Man | | up to 82% HI | W. Africa (29) |
| Man | 1 | | Senegal (33) |
| Man | | 15%/83 HI | USSR |
| Man | 8 | | Philippines |
| Man | | up to 70% NT | SE Asia |

| | | | |
|---|---|---|---|
| Man | 4 | | Cambodia |
| Man | Many | | Thailand (9), India (20, 23) |
| Bats (Scotophilus) | 2 | | Senegal (6, 29) |
| Bird (Auripasser) | 1 | | Nigeria (34) |
| Sentinel mice | 1;1 | | Nigeria (32);, Senegal (33) |
| Cercopithecus aethiops (blood) | 1 | | Senegal (37) |

Chimpanzee: HI positives in Liberia (26), 12/79 NT Congo (Leo)

Monkeys: HI positives in Ethiopia, Zimbabwe, S. Africa, Thailand

Domestic animals: 4/370 NT, S. Africa, 171/755 HI Thailand

Mosquitoes: Ae aegypti 1 Tanzania (1,2), 7 Thailand, 9 Nigeria (34),1 Senegal (33); Ae africanus Uganda(5,6), 1 Bangui (35); other Aedes 1 Nigeria (34),1 Senegal (33), 1 India (20); Mansonia spp. Uganda(6), 1 Nigeria (34); Culex quinquefasciatus 1 Tanzania (1,2) 1 Thailand, other Culex 1 Thailand.

Others: Ornithodoros erraticus sonrai 1 Senegal (44); Papio papio 1 Senegal (43).

## 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) | P-8 (S27) | ic 0.02 | Death, hem. Enteritis | 4 | 9.5 |
| Mice (nb) | P-10 (S15) | ip 0.02 | Death | | 7.8 |
| Mice (nb) | | sc | | | |
| Mice (wn) | P-8 (S27) | ic 0.03 | Antibody, occasional death | | |
| Mice (wn) | | ip 0.03 | Antibody | | |
| Mice (wn) | P-160 (S27) | ic 0.03 | Irregular deaths(4) | 7-13 | 8.0 |
| guinea pigs, hamsters (ad) | P-18 (TH3) | ic 0.1 | Antibody, occ. death (24,25) | | |
| rabbits (ad) | (S27) | ip 0.5 | Antibody (1) | | |
| wild rodents(ad) | Vereen. | ip | Viremia, antibody (13) | | |
| rhesus monkey | Acute ser. or mosq. | ip,sc | Fever, viremia, antibody (1,5) | | |
| wild monkeys | | | Viremia | | |
| chicks | | | Viremia, 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 |
| Mosquito transmission achieved with Aedes furcifer-taylori group (to man) (11), Ae aegypti (7), Ae calceatus, Ae triseriatus, Ae togoi, Ae pseudoscutellaris, Ae polynesiensis, Anopheles albimanus, Mansonia africana, Eretmapodites chrysogaster, Ae albopictus. | | | | | | | | | |

## Section X - Histopathology

Character of lesions (specify host)
**SM: encephalitic type damage to Ammon's horn, skeletal myositis, myocarditis (5), intestinal and sc haemorrhage. Haemorrhagic lesions also found in infant hamsters and white rats.**

Inclusion Bodies — Intranuclear

Organs/Tissues Affected
**Brain (LV), heart (LV), skeletal muscles (LV)**

Category of tropism
**Pantropic**

## Section XI - Human Disease

In Nature
**Significant**

Residual
**Reported**

Death

Subclinical

Overt Disease
**Reported**

Clinical Manifestations
**Fever (S), headache (S), prostration (R), conjunctival inflammation (R), myalgia (R), arthralgia (S), hemorrhagic signs (R), respiratory involvement (R), leukopenia (R), rash (S), lymphadenopathy (S),temp. may be diphasic (3)**

Number of Cases
**Hundreds**

Category (i.e. febrile illness, etc.)
**Febrile illness with rash**

## Section XII - Geographic Distribution

Known (Virus detected)
**Congo (Leo), S. Zimbabwe, Angola, Senegal, Nigeria, Thailand, India, Malayasia, Cambodia, Philippines**

Suspected (Antibody only detected)
**Mozambique, Ethiopia, Laos, Burma, S. Vietnam, USSR**

## Section XIII - References


1. ROSS, R.W. 1956. J. Hyg. 54:177.
2. LUMSDEN, W.H.R. 1955. Trans. R. Soc. Trop. Med. Hyg. 49:33.
3. ROBINSON, M.C. 1955. Ibid. 49:28.
4. MASON, P.J. and HADDOW, A.J. 1957. Ibid. 51:238.
5. WEINBREN, M.P., et al. 1958. Ibid. 52:253.
6. E. Afr. Virus Res. Inst. Reports. 1958-63 No. 9-13.
7. ROSS, R.W. 1956. J. Hyg. 54:192.
8. GEAR, J. and REID, F.P. 1957. S. Afr. Med. J. 31:253.
9. HAMMON, W.McD., et al. 1960. Science 131:1102.
10. MCINTOSH, B.M., et al. 1964. Ann. Trop. Med. Parasit. 58:45.
11. PATERSON, H.E. and MCINTOSH, B.M. 1964. Ibid. 58:52.
12. SMITHBURN, K.C., et al. 1959. S. Afr. Med. J. 33:555.
13. MCINTOSH, B.M. 1961. Trans. R. Soc. Trop. Med. Hyg. 55:63.
14. CALISHER, C.H., et al. 1980. Intervirology 14:229.
15. SPENCE, L.P. and THOMAS, L. 1959. Trans. R. Soc. Trop. Med. Hyg. 53:248.
16. CASALS, J. and THEILER, M. 1956. In Rivers and Horsfall. 1958. "Viral and Rickettsial Infections of Man", p. 299.
17. CASALS, J. 1957. Trans. N.Y. Acad. Sci. ser II 19:219.
18. BUCKLEY, S.M. 1959. Ann. NY Acad. Sci. 81:172.
19. LIM, et al. 1961. Singapore Med. J. 2:158.
20. PAVRI, K., et al. 1964. Ind. J. Med. Res. 52:629.
21. OSTERRIETH, et al. Ann. Soc. Belge. Med. Trop. 41:207*.
22. VERSTEEG, J. 1964. Archiv. ges.Virusforsch. 14:332.
23. SARKAR, J.K., et al. 1964. Ind. J. Med. Res. 52:684.
24. HAMMON, W.McD., et al. 1960. Trans. Assoc. Am. Phys. 73:140.
25. RUDNICK, A. and HAMMON, W.McD. 1960. Mosquito News 20:247.
26. RFVL, N.Y. Unpublished results. 1962.
27. RAO, T.R. 1964. Ind. J. Med. Res. 52:719.
28. WHITMAN, L. Personal communication.
29. BRES, P. Personal communication.
30. BOORMAN, J.P.T. and DRAPER, C.C. 1968. Trans. R. Soc. Trop. Med. Hyg.62:269.
31. PAVRI, K.M. 1964. Ind. J. Med. Res. 52:698.
32. CAUSEY, O.R., et al. 1969. Bull. Soc. Path. Exot. 62:249.
33. HANNOUN, C. and ECHALIER, A. 1971. Curr. Topics Microbiol. Immunol. 55:227.
34. CAUSEY, O.R. Personal communication.
35. Rapport Annuel de l'Institut Pasteur de Bangui. 1969.
36. BUCKLEY, S.M. Personal communication.
37. BERGOLD, G.H. and MAZZALI, R. 1967. J. Gen. Virol. 2:273.
38. Rapport Annuel de l'Institut Pasteur de Dakar. 1972.
39. PORTERFIELD, J.S. 1961. Bull. World Health Organ. 24:735.
40. KARABATSOS, N. 1975. Am. J. Trop. Med. Hyg. 24:527.
41. CHANAS, A.C., et al. 1976. J. Gen. Virol. 32:295.
42. CALISHER, C.H., et al. 1980. Am. J. Trop. Med. Hyg. 29:1428.
43. Rapport Annuel de l'Institut Pasteur de Dakar. 1983.
44. Taufflieb, R. et al. 1968. Cah. ORSTOM Ser. Ent. Med. 6:221-222.


## Remarks

***The patient Mbalolo described as a case of chikungunya by Osterrieth, et al. was, in fact, a case of yellow fever (see E. Afr. Virus Res. Inst. Rep. 1960-61. No. 11. p. 27).**