

# MINISTRY OF ENVIRONMENT & FORESTS

## NOTIFICATION

New Delhi, the 5th December, 1989

### **RULES FOR THE MANUFACTURE, USE, IMPORT, EXPORT AND STORAGE OF HAZARDOUS MICRO ORGANISMS GENETICALLY ENGINEERED ORGANISMS OR CELLS**

(To be notified under the EP Act, 1986)

**G.S.R. 1037(E).**-In exercise of the powers conferred by sections 6, 8 and 25 of the Environment (Protection) Act, 1986 (29 of 1986) and with a view to protecting the environment, nature and health, in connection with the application of genetechnology and micro-organisms, the Central Government hereby makes the following rules, namely:-

#### **1. Short title, extent and commencement**

(1) These rules may be called the Rules for the Manufacture, Use, Import, Export and Storage of Hazardous micro-organisms Genetically engineered organisms or cells.

(2) These rules shall come into operation on the date to be notified for this purpose in the Official Gazette.

#### **2. Application**

(1) These rules are applicable to the manufacture import and storage of micro-organisms and Gene-Technological products.

(2) These shall apply to genetically engineered organisms micro-organisms and cells and correspondingly to any substances and products and food stuffs, etc. of which such cells, organisms or tissues hereof form part.

(3) These rules shall also apply to new genetechnologies apart from those referred to in clauses (ii) and (iv) of rule 3 and these rules shall apply to organisms/micro-organisms and cells generated by the utilisation of such other gene-technologies and to substances and products of which such organisms and cells form part.

(4) These rules shall be applicable in the following specific cases;

(a) sale, offers for sale, storage for the purpose of sale, offers and any kind of handling over with or without a consideration;

(b) exportation and importation of genetically engineered cells or organisms;

(c) production, manufacturing, processing, storage, import, drawing off, packaging and repacking of the Genetically Engineered Products;

(d) Production, manufacture etc. of drugs and pharmaceuticals and food stuffs distilleries and tanneries, etc. which make use of micro-organisms genetically engineered micro-organisms one way or the other.

(5) These rules shall be applicable to the whole of India.

### **3. Definition**

In these rules unless the context requires,

(i) "Biotechnology" means the application of scientific and engineering principles to the processing of materials by biological agents to produce goods and services;

(ii) "Cell hybridisation" means the formation of live cells with new combinations of genetic material through the fusion of two or more cells by means of methods which do not occur naturally;

(iii) "Gene Technology" means the application of the gene technique called genetic engineering, include self-cloning and deletion as well as cell hybridisation;

(iv) "Genetic engineering" means the technique by which heritable material, which does not usually occur or will not occur naturally in the organism or cell concerned, generated outside the organism or the cell is inserted into said cell or organism. It shall also mean the formation of new combinations of genetic material by incorporation of a cell into a host cell, where they occur naturally (self cloning) as well as modification of an organism or in a cell by deletion and removal of parts of the heritable material;

(v) "microorganisms" shall include all the bacteria, viruses, fungi, mycoplasma, cells lines, algae, protodones and nematotes indicated in the schedule and those that have not been presently known to exist in the country or not have been discovered so far.

### **4. Competant Authorities**

(1) Recombinant DNA Advisory Committee (IXDAC)

This committee shall review developments in Biotechnology al national and international levels and shall recommend suitable and-appropriate safety regulations for India in recombinant research, use and applications from time to time. The committee shall function in the Department of Biotechnology.

(2) Review Committee on Genetic Manipulation (RCGM).

This committee shall function in the Department of Biotechnology to monitor the safety related aspect in respect of on-going research projects and activities involving genetically engineered organisms/hazardous microorganisms. The Review Committee on Genetic Manipulation shall include representatives of (a) Department of

Biotechnology (b) Indian Council of Medical Research (c) Indian Council of Agricultural Research (d) Council of Scientific and Industrial Research

(e) other experts in their individual capacity. Review Committee on Genetic Manipulation may appoint sub groups.

It shall bring out Manuals of guidelines specifying procedure for regulatory process with respect to activities involving genetically engineered organisms in research use and applications including industry with a view to ensure environmental safety. All ongoing projects involving high risk category and controlled field experiments shall be reviewed to ensure that adequate precautions and containment conditions are followed as per the guidelines.

The Review Committee on Genetic Manipulation shall lay down procedures restricting or prohibiting production sale importation and use of such genetically engineered organisms of cells as are mentioned in the Schedule.

(3) Institutional Biosafety Committee (IBSC).

This committee shall be constituted by an occupier or any person including research institutions handling microorganisms/genetically engineered organisms. The committee shall comprise the Head of the Institution Scientists engaged in DNA work a medical expert and a nominee Of the Department of Bioecology. The occupier or any person including research institutions having microorganisms/genetically engineered organisms shall prepare A he assistance of the Institutional Biosafety Committee (IBSC) an uptodate on-site emergency plan according to the manuals/guidelines of the RCGM and make available copies to the District Level Committee/State Biotechnology Co-ordinating Committee and the Genetic Engineering Approval Committee.

(4) Genetic Engineering Approval Committee (GE.AC)

This committee shall function as a body under the Department of Environment Forests and Wildlife for approval of activities involving large scale use of hazardous microorganisms and recombinants in research and industrial production from the environmental angle. The Committee shall also bc responsible for approval of proposals relating to release of genetically engineered organisms and products into the environment including experiment Field trials.

The composition of the Committee shall be

(i) Chairman-Additional Secretary Department of Environment Forests and Wild life

Co-Chairman Representative of Department of Bio-technology

(ii) Members: Representatives of concerned Agencies and departments namely Ministry of Industrial Development, Department of Biotechnology and the Department of Atomic Energy.

(iii) Expert members: Director General-Indian Council of Agricultural Research, Director General-Indian Council of Medical Research, Director General-Council of Scientific and Industrial Research, Director General Health Services, Plant Protection Adviser, Directorate of Plant Protection, Quarantine and storage, Chairman, Central Pollution Control Board and three outside experts in individual capacity.

(iv) Member Secretary: An official of the Department of Environment, Forest and Wildlife.

The Committee may co-opt other members/experts as necessary.

The committee or any person/s authorised by it shall have powers to take punitive actions under the Environment (Protection) Act.

#### (5) State Biotechnology Co-ordination Committee (SBCC).

There shall be a State Biotechnology Coordination Committee in the States wherever necessary. It shall have powers to inspect, investigate and take punitive action in case of violations of statutory provisions through the Nodal Department and the State Pollution Control Board/Directorate of Health/Medical Services. The Committee shall review periodically the safety and control measures in the various industries/institutions handling genetically engineered Organisms/Hazardous microorganisms. -The compositions of the Coordination Committee shall be:

(i)	Chief Secretary	-
	Chairman	
(ii)	Secretary, Department of Environment	- Member
	Secretary	
(iii)	Secretary, Department of Health	
	- Member	
(iv)	Secretary, Department of Agriculture	- Member
(v)	Secretary, Department of Industries and Commerce	- Member
(vi)	Secretary, Department of Forests	- Member
(vii)	Secretary, Department of Public Works/Chief Engineer, Department of Public Health Engineering.	- Member
(viii)	State Microbiologists and Pathologists	- Member
(ix)	Chairman of State Pollution Control Board	

The Committee may co-opt other members/experts as necessary.

#### (6) District Level Committee (DLC)

There shall be a District Level Biotechnology Committee (DLC) in the districts wherever necessary under the District Collectors to monitor the safety regulations in installations engaged in the use of genetically modified organisms/ hazardous microorganisms and its applications in the environment.

The District Level Committee/or any other person/s authorised in this behalf shall visit the installation engaged in activity involving genetically engineered organisms, hazardous microorganisms, formulate information chart, find out hazards and risks associated with each of these installations and coordinate activities with a view to

meeting any emergency. They shall also prepare an off-site emergency plan. The District Level Committee shall regularly submit its report to the State Biotechnology Co-ordination Committee/Genetic Engineering Approval Committee.

The District Level Committee shall comprise of:-

- (i) District Collector  
- Chairman
- (ii) Factory Inspector  
- Member
- (iii) A representative of the Pollution Control Board  
- Member
- (iv) Chief Medical Officer (District Health Officer)  
- Member (Convenor)
- (v) District Agricultural Officer  
- Member
- (vi) A representative of the Public Health Engineering Department  
- Member
- (vii) District Microbiologists/Pathologist (technical expert) - Member
- (viii) Commissioner Municipal Corporation  
- Member

The Committee may co-opt other members/experts as necessary.

## **5. Classification of microorganisms or genetically engineered product**

(1) For the purpose of these rules, microorganisms or genetically engineered organisms, products or cells shall be dealt with under two major heads; animal, pathogens and plant pests and these shall be classified in the manner specified in the Schedule.

(2) If any of the microorganisms, genetically engineered organism or cell falls within the limits of more than one risk class as specified in the Schedule, it shall be deemed to belong exclusively to the last in number of such classes.

6. Microorganisms laid down in the Schedule are divided into the following:-

- (i) Bacterial Agents;
- (ii) Fungal Agents;
- (iii) Parasitic Agents;
- (iv) Viral, Rickettsial and Chlamydial Agents;
- (v) Special Category.

## **7. Approval and Prohibitions etc.**

(1) No person shall import, export, transport, manufacture, process, use or sell any hazardous microorganisms of genetically engineered organisms/substances or cells except with the approval of the Genetic Engineering Approval Committee.

(2) Use of pathogenic microorganisms or any genetically engineered organisms or cells for the purpose of research shall only be allowed in laboratories or inside laboratory area notified by the Ministry of Environment and Forests for this purpose under the Environment (Protection) Act, 1986.

(3) The Genetic Engineering Approval Committee shall give directions to the occupier to determine or take measures concerning the discharge of microorganisms/genetically engineered organisms or cells mentioned in the Schedule from the laboratories, hospitals and other areas including prohibition of such discharges and laying down measures to be taken to prevent such discharges.

(4) Any person operating or using genetically engineered organisms/microorganisms mentioned in the schedule for scale up or pilot operations shall have to obtain licence issued by the Genetic Engineering Approval Committee for any such activity. The possessor shall have to apply for licence in prescribed proforma.

(5) Certain experiments for the purpose of education within the field of gene technology or microorganism may be carried out outside the laboratories and laboratory areas mentioned in sub-rule (2) and will be looked after by the Institutional Biosafety Committee.

## **8. Production**

Production in which genetically engineered organisms or cells or micro-organisms are generated or used shall not be commenced except with the consent of Genetic Engineering Approval Committee with respect of discharge of genetically engineered organisms or cells into the environment. This shall also apply to production taking place in connection with development, testing and experiments where such production, etc., is not subject to rule 7.

## **9. Deliberate or unintentional release**

(1) Deliberate or unintentional release of genetically engineered organisms/hazardous microorganisms or cells, including deliberate release for the purpose of experiment shall not be allowed.

Note: Deliberate release shall mean any intentional transfer of genetically engineered organisms/hazardous, microorganisms or cells to the environment or nature, irrespective of the way in which it is done.

(2) The Genetic Engineering Approval Committee may in special cases give approval of deliberate release.

## **10. Permission and approval for certain substances**

Substances and products, which contain genetically engineered organisms or cells or microorganisms shall not be produced, sold, imported or used except with the approval of Genetic Engineering Approval Committee.

## **11. Permission and approval for food stuffs**

Food stuffs, ingredients in food stuffs and additives including processing and containing or consisting of genetically engineered organisms or cells, shall not be produced, sold, imported or used except with the approval of the Genetic Engineering Approval Committee.

## **12. Guidelines**

(1) Any person who applies for approval under rules 8-11 shall, as determined by the Genetic Engineering Approval Committee submit information and make examinations or cause examinations to be made to eradicate the case, including examinations according to specific directions and at specific laboratories. He shall also make available an on-site emergency plan to GEAC before obtaining the approval. If the authority makes examination itself, it may order the applicant to delay the expenses incurred by it in so doing.

(2) Any person to whom an approval has been granted under rules 8-11 above shall notify the Genetic Engineering Approval Committee of any change in or addition to the information already submitted

## **13. Grant of approval**

(1) In connection with the granting of approval under rules 8 to 11 above, terms and conditions shall be stipulated, including terms and conditions as to the control to be exercised by the applicant, supervision, restriction on use, the layout of the enterprise and as to the submission of information to the State Biotechnology Co-ordination Committee or to the District Level Committee.

(2) All approvals of the Genetic Engineering Approval Committee shall be for a specific period not exceeding four year at the first instance renewable for 2 years at a time. The Genetic Engineering Approval Committee shall have powers to revoke such approval in the following situations:-

(a) If there is any new information as to the harmful effects of the genetically engineered organisms or cells.

(b) If the genetically engineered organisms or cells cause such damage to the environment, nature or health as could not be envisaged when the approval was given, or

(c) Non compliance of any condition stipulated by Genetic Engineering Approval Committee.

## **14. Supervision**

(1) The Genetic Engineering Approval Committee may supervise the implementation of the terms and conditions laid down in connection with the approvals accorded by it.

(2) The Genetic Engineering Approval Committee may carry out this supervision through the State Biotechnology Coordination Committee or the State Pollution Control Boards/District Level Committee or through any person authorised in this behalf.

## **15. Penalties**

- (1) If an order is not complied with, the District Level Committee or State Biotechnology Co-ordination Committee may take measures at the expense of the person who is responsible.
- (2) In case where immediate intervention is required in order to prevent any damage to the environment, nature or health, the District level Committee or State Biotechnology Coordination Committee may take the necessary steps without issuing any order or notice. The expenses incurred for this purpose will be repayable by the person responsible for such damage.
- (3) The State Biotechnology Co-ordination Committee/District Level Committee may take samples for a more detailed examination of organisms and cells.
- (4) The State Biotechnology Co-ordination Committee/District Level Committee shall be competent to ask for assistance from any other government authority to carry out its instructions.

#### **16. Responsibility to notify interruptions or accidents**

- (1) Any person who under rule 7-11 is responsible for conditions or arrangements shall immediately notify the District Level Committee/State Biotechnology Co-ordination Committee and the state medical officer of any interruption of operations or accidents that may lead to discharges of genetically engineered organisms or cells which may be harmful to the environment, nature or health or involve any danger thereto.
- (2) Any notice given under sub-rule (1) above shall not lessen the duty of the person who is responsible to try effectively to minimise or prevent the effects of interruptions of operations or accidents.

#### **17. Preparation Off-site emergency Plan by the DLC**

- (1) It shall be the duty of the DLC to prepare an off-site emergency plan detailing how emergencies relating to a possible major accident at a site will be dealt with and in preparing the plan, the DLC shall consult the occupier and such other person as it may deem necessary.
- (2) For the purpose of enabling the DLC- to prepare. the emergency plan required under sub-rule (1), the occupier shall provide the DLC with such information relating to the handling of hazardous microorganisms/ genetically engineered organisms under his control as the DLC may required including the nature, extent and likely off-site affects of a possible major accident and the DLC shall provide the occupier with any information from the off-site emergency plan which relates to his duties under rule 16.

#### **18. Inspections and informations regarding finance**

- (1) The State Biotechnology Co-ordination Committee or the Genetic Engineering Approval Committee/the DLC or any person with special knowledge duly authorised by the State Biotechnology Co-ordination Committee or the Genetic Engineering Approval Committee or the DLC where it is deemed necessary, at any time on due



production of identity be admitted to public as well as to private premises and localities for the purpose of carrying out supervision.

(2) Any person who is responsible for activities subject to rules 7-11 above shall at the request of District level Committee or State Biotechnology Coordination Committee or the GEAC submit all such information including information relating to financial conditions and accounts, as is essential to the authority's administration under these rules He shall also allow supervision or inspection by the authorities or persons indicated in sub-rule (1).

(3) The Genetic Engineering Approval Committee may fix fees to cover, in whole or in part, the expenses incurred by the authorities in connection with approvals, examinations, supervisions and control.

### **19. Appeal**

(1) Any person aggrieved by a decision made by Genetic Engineering Approval Committee/State Biotechnology Co-ordination Committee in pursuance of these rules may within thirty days from the date on which the decision is communicated to him, prefer an appeal to such authority as may be appointed by Ministry of Environment and Forests provided that the appellate authority may entertain the appeal after the expiry of the said period of thirty days if such authority is satisfied that the appellant was prevented by sufficient cause from filing the appeal in time.

### **20. Exemption**

The Ministry of Environment and Forests shall, wherever necessary, exempt an occupier handling a particular microorganism/genetically engineered organism from rule 7-11.

## **ANIMAL AND HUMAN PATHOGENS SCHEDULE**

### **BACTERIAL**

#### **Risk Group II**

Acinetobacter calcoaceticus  
Actinobacillus all species except A mallei, which in Risk Group III  
Acromonosas hydrophila  
Arzonia hinshawii-all serotypes  
Bacillus anthracis  
Bordetella-all species  
Borrelia recurrentis B. vincenti  
Campylobacter fetus  
Campylobacter jejuni  
Chlamydia psittaci  
Chlamydia trachomatis  
Clostridium haemocytus, Cl. Difficile Cl. fallax, Cl. haemolyticum Cl. histolyticum,  
Cl. novyi, (Cl. perfringens), Cl. speticum, Cl. sordeili  
Corynebacterium diphtheriae, C. equi, C. haemolyticum, C. pseudo  
tuberculosis, C. pyogenes, C. renale  
Diplococcus (Streptococcus) pneumoniae

Edwardsiella tarda  
Erysipelothrix insidiosa  
Escherichia Coli-all enteropathogenic serotypes enterotaxigenic  
Haemophilus ducreyi, H. influenzae, H. pneumoniae  
Herellea vaginicola  
Klebsiella- all species and all serotypes  
Legionella pneumophila  
Listeria  
Leptospira interrogans all serotypes reported in India  
Listeria, all species  
Mima polymorpha  
Moraxella-All species  
Mycobacteria-all species including Mycobacterium avium  
M. bovis M. tuberculosis, M. leprae  
Mycoplasma-all species except M. mycoides and M. agalactiae  
Neisseria gonorrhoea, N. meningitidis  
Pasteurella all species except those listed in Risk Group III  
Salmonella-all species and all serotypes  
Shigella all species and all serotypes  
Shigella flexneri  
Staphylococcus aureus  
Streptococcus moniformis  
Streptococcus pneumoniae  
Streptococcus pyogenes, S. equi  
Streptomyces madurae, S. pelleteri, S. somaliensis  
Treponema carateum, T. pallidum and T. pertenue  
Vibrio cholerae, V. comma including biotype El Tor and  
V. parahaemolyticus.  
Vibrio cholerae

### **Risk Group III:**

Actinobacillus mallei  
Bacteroides-all species  
Brucella all species  
Clostridium botulinum, Cl. tetani  
Francisella tularensis  
Mycobacterium avium, M. bovis, M. tuberculosis, M. leprae  
Pasteurella multocida type B ("buffalo" and other foreign virulent strains)  
Pseudomonas pseudomallei  
Yersinia pestis

### **FUNGAL**

#### **Risk Group II**

Actinomycetes (including Nocardia Sp, Actinomyces species and Arachnia  
propinqua)  
Aspergillus fumigatus  
Blastomyces dermatitidis  
Cryptococcus neoformans C. fersiminosos

Epidermophyton madurella, microsporon  
Paracoccidioides brasiliensis  
Sporothrix  
Trichodenna  
Trichophyton

### **Risk Group III**

Coccidioaes immitis Histoplasma capulatum  
Histoplasma capsulalum var duboissl

### **PARASITIC**

#### **Risk Group II**

Entahoe'oa histolytica  
Leishmania species  
Naegeleria gruberia  
Plasmodium theilera, P. babesia P. falcoparum  
Plasmodium babesia  
Schistosoma  
Toxoplasma gondii  
Toxocara canis  
Trichinella spiralis  
Trichomanas  
Trypanosoma cruzi

### **Risk Group III**

Schisistosoma mansoni

### **VIRAL RICKEITSIAL AND CHAIMYDIAL**

#### **Risk Group II**

Adenoviruses-Human, all types  
Avian loukosis  
Cache Valley virus  
CELO (avain adenovirus)  
Cosackie A and B viruses  
Corona viruses  
Cytomegalo viruses  
Dengue virus, when used for transmission experiments  
Echo viruses-all types  
Encephalomyocarditis virus (EMC)  
Flanders virus  
Hart Past virus  
Hepatitis-associated antigen material-hepatitis A and B viruses, non A and non B, HDV  
Herpes viruses-except herpes virus simiae (monkey B virus) which is in Risk Group IV.  
Infections Bovine Rhinotraechitis virus (IBR).

Infections Bursal diseases of poultry and Infectious Bronchitis  
Infections Laryngotracheitis (ILT)  
Influenza virus-all types, except A/PR8/34 which in Risk Group I  
Langkat virus Leucosis Complex  
Lymphogranuloma venereum agent  
Mark's Disease virus  
Measles virus  
Mumps virus  
Newcastle disease virus (other than licenced strain for vaccine use)  
Parainfluenza viruses-all types except parainfluenza virus 3, SF4 strain, which is in Risk Group I  
Polio viruses-all types wild and attenuated  
Poxvirus-all types except Mastrom, monkey pox, sheep pox and white pox, which depending on experiments are in Risk Group III or IV.  
Rabies virus-all strains except rabies street virus, which should be classified in Risk Group III when inoculated into comivores  
Reoviruses-all types  
Respiratory syncytial virus  
Rhinoviruses-all types  
Rinderpest (other than vaccine strain in use)  
Rubella virus  
Simian viruses-all types except herpesvirus simiae (Monkey Virus) which is in Risk Group IV.  
Simian virus 40  
Ad 7 SV 40 (defective)  
Sindbis virus  
Tensaw virus  
Turlock virus  
Vaccinia virus  
Varicella virus  
Vole rickettsia  
Yellow fever virus, 17 D vaccine strain

### **Risk Group III**

African Horse Sickness (attenuated strain except animal passage)  
Alastrim, monkey pox and whitepox, when used in vitro  
Arboviruses-All strains except those in Risk Group II and IV  
Blue tongue virus (only serotypes reported in India)  
Ebola fever Virus  
Epstein-Barr virus  
Feline Leukemia  
Feline sarcoma  
Foot and Mouth Disease virus (all serotypes and subtypes)  
Gibbon Ape Lymphosarcoma  
herpesvirus atles  
herpesvirus saimiri  
herpes Simplex 2  
HIV-1 & HIV-2 and strains of SIV  
Infectious Equine Anaemia

Lymphocytic choriomeningitis virus (LCM)  
Monkey pox, when used in vitro  
Non-defective Adeno-2 SV-40 hybrids  
Pseudotacosis-ornithosis-trachoma group of agents  
Pseudorabies virus  
Rabies street virus, when used inoculations of carnivores  
Ricktsia-all species except Vole rickettsia on Coxiell burnetti when used for vector transmission or animal inoculation experiments  
Sheep pox (field strain)  
Swine Fever virus  
Vesicular stomatitis virus  
Woolly monkey Fibrosarcoma  
Yaba pox virus

#### **Risk Group IV**

Alastrim, monkeypox, whitepox, when used for transmission or animal inoculation experiments

Hemorrhagic fever agents, including Crimean hemorrhagic fever (congo)

Korean hemorrhagic fever and others as yet undefined

Herpesvirus simlae (monkey B virus)

Tick-borne encephalitis virus complex, including-Russian Spring Summer Encephalitis, Kyasanur Forest Disease, Omsk hemorrhagic fever and Central European encephalitis viruses

#### **SPECIAL CATEGORY**

#### **BACTERIAL**

Contagious Equine Metritis (*H. equinilis*) Pestis-petit de ruminantium

#### **VIRAL RICKETTSIAL AND CHLAMYDIAL:**

African Horse Sickness virus (serotypes not reported in India and challenge strains)

African Swine Fever

Bat rabies virus

Blue tongue virus (serotypes not reported in India)

Exotic FMD virus types and sub-types

Junin and Machupo viruses

Lassa virus

Marburg virus

Murray valley encephalitis virus

Rift Valley Fever virus

Smallpox virus-Archival storage and propagation Swine Vesicular Disease

Venezuelan equine encephalitis virus epidemic strains

Western Equine encephalitis virus  
Yellow fever virus-Wild strain  
Other Arboviruses causing zoonoses and so far not recorded in India.

## **B: PLANT PESTS**

Any living stage (including active and dormant forms) of insects, mites, nematodes, slugs, snails, bacteria, fungi, protozoa, other parasitic plants or reproductive parts thereof: viruses or any organisms similar to or allied with any of the foregoing; or any infectious agents or substances, which can directly or indirectly injure or cause disease or damage in or to any plants or parts thereof, or any processed, manufactured, or other products of plants are considered plant pests.

Organisms belonging to all lower Taxa contained within the group listed are also included. **1. Viruses**

All viruses

Alt bacteria, fungal, algal, plant, insect and nematode viruses; special care should be taken for-

- (i) Geminiviruses,
- (ii) Calulimoviruses,
- (iii) Nuclear Polyhedrosis viruses,
- (iv) Grandulosis viruses, and
- (v) Cytoplasmic polyhedrosis viruses

## **2. Bacteria**

Family Pseudomonadaceae  
Genus Pseudomonas  
Genus Xanthomonas  
Genus Azolobacter

### **Family Rhizobiaceae**

Genus Rhizobium/Azorhizobium  
Genus Bradyrhizobium  
Genus Agrobacterium  
Genus Phyllobacterium  
Genus Erwinia  
Genus Enterobacter  
Genus Klebsiella

### **Family Spirochaetaceae**

Genus Azospirillum  
Genus Acetivibrio  
Genus Clostridium  
Family Sphaeromonadaceae

Genus Streplomyces  
Genus Nocardia

**Family Actionmycetaceas**  
Genus Aclinomyces

**Coryneform Group**

Genus Clavibacter  
Genus Arthrobacter  
Genus Curlobacterium  
Genus Bdellovibro  
Family Rickettsiaceae

Rickettsial like organisms associated with insect diseases

Gram-negative phloem-limited bacteria associated with plant diseases

Gram-negative xylem-limited bacteria associated with plant diseases

Cynobacteria-all members of blue-green algae

Mollicutes

Family Spiroplasmataceae

Mycoplasma-like organisms associated with plant diseases

Mycoplasma-like organisms associated with insect diseases

**Algae**

Family Chloophyceae  
Family Euglenophyceae  
Family Pyrophyceae  
Family Chrysophyceae  
Family Phacophyceae  
Family Rhodophyceae

**Fungi**

Family Plasmodiophoraceae  
Family Chytridiaceae  
Family Oldipopsidaceae  
Family Synchronytriaceae  
Family Catenariaceae  
Family Coelomomycetaceae  
Family Saprologniaceae  
Family Zoopagaceae  
Family Albuginaceae

Family Peronosporaceae  
Family Pythiaceae  
Family Mucoraceae  
Family Choanephoraceae  
Family Mortierellaceae  
Family Endogonaceae  
Family Synecephalastraceae  
Family Dimargaritaceae  
Family Kickxellaceae  
Family Saksenaaceae  
Family Entomophthoraceae  
Family Eecrinaceae  
Family Taphrinaceae  
Family Endomycotaceae  
Family Saccarymycetaceae  
Family Eutoliaceae  
Family Gymnoasceae  
Family Asephaeriaeae  
Family Onygenaceae  
Family Microascaceae  
Family Protomycetaceae  
Family Elsinoeaceae  
Family Mynaginaceae  
Family Dothidiaceae  
Family Chaetothyriaceae  
Family Pharmulariaceae  
Family Phillipsicllaceae  
Family Gysteriaceae  
Family Pleosporaceae  
Family Melamomataceae  
Family Ophiostomataceae  
Family Aseosphaeriaceae  
Family Erysiphaceae  
Family Meliolaceae  
Family Xylariaceae  
Family Diaporthaceae  
Family Hypoeraceae  
Family Clavicipataceae  
Family Phacidiaceae  
Family Ascocorticiaceae  
Family Hemiphacidiaceae  
Family Dennataceae  
Family Selerotimiaceae  
Family Cyttariaceae  
Family Helosiaceae  
Family Sarocostomataceae  
Family Sarcoscyphaceae  
Family Auricolariaceae  
Family Ceratobasidiaceae  
Family Corticiaceae



Family Hymenochaetaceae  
Family Echiondintiaceae  
Family Eistuliniaceae  
Family Clavariaceae  
Family Polyporaceae  
Family Tncholomataceae  
Family Ustilaginaceae  
Family Sporobolomycetaceae  
Family Uredinaceae  
Family Agaricaceae  
Family Graphiolaceae  
Family Pucciniaceae  
Family Mclampsoraceae  
Family Gandodermataceae  
Family Labonlbeniaceae  
Family Sphaeropsidaceae  
Family Mclabconiaceae  
Family Tuberculariaceae  
Family Dematiaceae  
Family Moniliaceae  
Family Aganomucotaceae

### **Parasitic Weeds**

Family Balanophoraceae-parasitic species  
Family Cuscutaceae-parasitic species  
Family Thydonoraceae-parasilic species  
Family Lauraceae-parasitic species Genus Cassytha  
Family Lennoaceae-parasilic species  
Family Loranhaceae-parasitic species  
Family Myzodendraceae-parasitic species  
Family Olacaceae-parasitic species  
Family Orobanchaceae-parasitic species  
Family Rafflesiaceae-parasitic species  
Family Santalaceae-parasitic species  
Family Scrophulariaceae-parasitic species

### **Protozoa**

Genus Phytomonas  
And all Protozoa associated with insect dest

### **Nematodes**

Family Anguinidae  
Family Belonolaimidae  
Family caloosiidae  
Family Cariconematidae  
Family dolichodoridae  
Family Fergusbbiidae

Family hemicycliophoridae  
Family Heteroderidae  
Family Hoplolaimidae  
Family Mclodogynidae  
Family Neotylenchidae  
Family Nolhotylenchidae  
Family Paralylenchidae  
Family Pralyjenchidae  
Family Tylenchidae  
Family Tylenchulidae  
Family Aphelenchoidae  
Family Longdoridae  
Family Tlichodoridae

## **Mollusca**

Super family Planorbacca  
Super family Achatinacca  
Super family Arionacca  
Super family Limacacca  
Super family Helicacea  
Super family Vcronicellacea

## **Arthropoda**

Super family Ascoidea  
Super family Dermanyssoidea  
Super family Erjophyoidea  
Super family Tetranychoida  
Super family Tetranychoida  
Super family Eupododca  
Super family Tydcoidea  
Super family Erythraenoidca  
Super family Trombidioida  
Super family Hydryphantoidea  
Super family Tarasonemoidea  
Super family Pyomotoioida  
Super family Hcmisaracoptoidea  
Super family Acaroidea  
Order Polydesmida  
Family Sminlhoridao  
Family Forfieulidzo  
Order Isptera  
Order Thysanoptera  
Family Acredidea  
Family Gryllidae  
Family Gryllacridiedae  
Family Gryllotalpidae  
Family Phasmatidao

Family Ronalcidao  
Family Tettigoniidao  
Family Tatragidao  
Family Thaumastocoridae  
Super family Picsmaloidca  
Super family Lygacoidea  
Super family Idiosloloidea  
Super family Careoidea  
Super family Penalomoidea  
Super family Pyrrhoeomidea  
Super family Tingoidea  
Super family Miroidea  
Order Homoplara  
Family Anobiidae  
Family Apionidae  
Family Anthrididae  
Family Bosirichidae  
Family Brentidae  
Family Bruchidae  
Family Bupresiodae  
Family Byturidae  
Family Caniharidae  
Family Carabidae  
Family Ceambienidae  
Family Chrysomelidae  
Family Coecinellidae  
Family Curculionidae  
Family Dermestidae  
Family Elateridae  
Family Hydrophilidae  
Family Lyctidae  
Family Meloidae  
Family Moredellidae  
Family Platypodiadae  
Family Scarabaeldae  
Family Scolylidae  
Family Selbytidae  
Order Lepidoptera  
Family Agromyiidae  
Family Anthomiidae  
Family Cecidomiidae  
Family Chioropidae  
Family Ephydriidae  
Family Lonchacidae  
Family Musicdae  
Family Otitidac  
Family Syrphidae  
Family Tephрилidae  
Family Tipulidae  
Family Apidae

Family Caphidae  
Family Chalcidae  
Family Cynipidae  
Family Eurytomidae  
Family formisidae  
Family Psilidae  
Family Sircidae  
Family Tenthredinidae  
Family Torymidae  
Family Xyloioipidae

and

also unclassified organism and/or organisms whose classification is unknown, and all other organisms associated with plant and insect disease.

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