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INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS
GENEVA

Associated Document
to the
General Introduction to the Examination
of Distinctness, Uniformity and Stability and the
Development of Harmonized Descriptions of New Varieties of Plants (document TG/1/3)

DOCUMENT TGP/12

“SPECIAL CHARACTERISTICS”

**Section TGP/12.1.1: Characteristics Expressed in Response
to External Factors: Disease Resistance**

Document prepared by experts from the Netherlands

to be considered by the

*Technical Working Party for Vegetables (TWPV), at its thirty-sixth session to be held in
Tsukuba, Japan, from September 9 to 13, 2002*

*Technical Working Party for Agricultural Crops (TWPAC), at its thirty-first session to be held in
Rio de Janeiro, Brazil, from September 23 to 27, 2002*

*Technical Working Party for Ornamental Plants and Forest Trees (TWPOT), at its thirty-fifth
session to be held in Quito, from November 18 to 22, 2002*

*Technical Working Party for Fruit Crops (TWPFC), at its thirty-third session to be held in
San Carlos de Bariloche, Argentina, from November 25 to 29, 2002*

SECTION 12.1.1

CHARACTERISTICSEXPR ESSEDINRESPONSE TO EXTERNALFACTORS; DISEASERESISTANCE

1. The breeding for resistance to pests and diseases is an important part of many breeding programs. In Vegetables more than 50% of the breeding effort is devoted to resistance.
2. For farmers, having to cope with strong pressure to reduce the use of crop protecting chemicals, the availability of varieties that can resist diseases without protection by chemicals is crucial.
3. The correct description of the resistance characteristics in variety descriptions, breeder's catalogues etc. is considered very important. In many cases problems and legal cases were caused by insufficient description of the resistance.
4. The input from science on the taxonomy of the diseases and of the strains of diseases is decreasing rapidly around the world.
5. More and more the breeding industry joins forces to fill this gap by combining their resources, usually under the FIS/ASSINSEL (now IFS) umbrella.
6. Disease resistance characteristics may be used as characteristics in the framework of the DUS test for Plant Breeders' Rights, provided a number of criteria are fulfilled;
 - (a) it must be capable of precise definition;
 - (b) it must produce constant and repeatable results for existing varieties;
 - (c) it must allow uniformity requirements to be fulfilled;
 - (d) it must be clearly defined in the observation and evaluation of the results;
 - (e) for inclusion in the Test Guidelines it must allow a clear differentiation to be made in the collection of the species concerned;
 - (f) it must not lead to easy plagiaristic practices.
7. In general these requirements can be fulfilled but a number of requirements pose specific problems:
8. Ad (a) it must be capable of precise definition
 - I. The definition of the disease itself usually does not create problems, for the proper denomination internationally accepted standards may be used such as the American Phytopathological Society (APS) for fungi and bacteria and the International Committee for Taxonomy of Viruses (ICTV).
9. Ad (a) it must be capable of precise definition
 - II. The definition and denomination of the races and strains per disease pose a specific, more complicated problem as almost no longer any scientific work is done on this subject. This can result in confusing situations where the same race / strain could be named differently in Europe and the USA p.e. *Fusarium oxysporum* f.sp. *lycopersici* (Fol) in tomato where race 1

in the USA is identical to race 0 in Europe. Also different races/strains may have the same name p.e. *Fusarium oxysporum* f.sp. *lycopersici* (Fol) in tomato where race 2 in the USA is different from race 2 in Europe. At the moment a joint effort is made by FIS/ASSINSEL (now IFS) on this subject with the aim to create one clear system of definition and nomination. The core of this system is the precise definition of a set of host differential lines/varieties with which the races / strains can be determined. The seed industry is willing to cooperate by maintaining the necessary stocks of seed for this purpose.

10. In annex (I) the definition of the various terms as developed and used by FIS/ASSINSEL (now IFS) is given. In Annex (II) a list of diseases where it is known that resistance breeding has been carried out. Comments on this list are welcome on the FIS/ASSINSEL (now IFS) website.

11. Ad(a) The cooperation with breeders also results in better knowledge on the genetical background of the various forms of disease resistance. Knowing which genes are responsible for resistance and if it concerns a single gene or a combination of genes gives valuable information that will help to properly observe and evaluate the resistance.

12. Ad(b) it must produce constant and repeatable results for existing varieties; Repeated tests and ring tests have shown that the stability of disease resistance, provided this was established on race/strain level is very good. In fact, as disease resistance is of crucial importance for the marketing of varieties, it is a primary selection criteria for companies to check the varietal stability.

13. Ad(c) it must allow uniformity requirements to be fulfilled Testing for disease resistance characteristics means introducing more variables in the trial; not only the development of the plants is subject to the environment, but also the quality of the inoculum, the inoculation and the interaction between symptom and development of the plant may cause variation within the trial. It has to be avoided to attribute the trial induced heterogeneity to the candidate variety.

14. Ad(d) it must be clearly defined in the observation and evaluation of the results Following the provided explanations in the test protocols, ring tests have shown to give deviating results. These deviations were caused by variation in the climatical conditions under which the trials were carried out. Also different interpretation of the symptoms by different observers was noted. The conclusion of these trials was that only if a correct set of standards was included in the trial, the observations and evaluation of the results was harmonized. It was however observed that slight differences in the standards (between lot differences) could cause problems. The advice here is to develop a centralised set of standards per disease or per strain to avoid problems. The seed industry is willing to cooperate by maintaining the necessary stocks of seed for this purpose.

15. Ad(e) it must allow a clear differentiation to be made in the collection of the species concerned.

Disease resistance characteristics, properly tested, give per definition a clear differentiation in the variety collections. In fact in many cases disease resistance characteristics may be used as grouping characteristics. The differentiation usually may take place even on race/strain level as many collections of varieties are known to show different resistance reactions to different races/strains of the disease. Also on race/strain level grouping may be done, provided the races/strains are properly identified. A specific problem are those diseases or races/strains of diseases, where the difference between susceptible and resistant is not discontinuous, but in

fact as scale of resistance can be observed ranging from absent to very weak to very strong. In the practice of the guidelines diseases that show this phenomenon are usually treated as discontinuous by defining a threshold dividing susceptible from resistant. This practice will have to be replaced by a more precise description of the different levels of uniformity. These levels have to be defined precisely and standards will have to be included in the tests to enable the differentiation between the different levels.

16. Ad(f) it must not lead to easy plagiaristic practices.

The breeding effort necessary to cross resistance in a susceptible variety is usually a complicated and time-consuming job. This alone is sufficient safeguard against plagiaristic.

17. As additional points for consideration the following have to be taken into account:

(g) the availability of reliable inoculum

(h) quarantine regulations

(i) the costs involved in disease resistance testing

18. Ad(g) the availability of reliable inoculum

In general a few institutes are still maintaining stocks of inoculum of most of the diseases that are used in breeding programs. In the explanation of the methods in the guidelines, the available information on these sources will have to be indicated. If inoculum from another source is used, a defined host differential set will have to be used to clearly identify the inoculum.

19. Ad(h) quarantine regulations

With a world wide organisation as UPOV it is unavoidable that diseases that are of importance in a certain area, are unknown to cause problems in another part of the world and are there considered as quarantine diseases. Usually this means that the import of inoculum and the test itself is not possible. A good way to solve these kind of problems is to contact a DUS testing authority elsewhere and ask them to carry out the test.

20. Ad(i) The costs and technical requirements of disease tests are for some DUS testing authorities impassable barriers to carry out these tests. Two options may be considered to overcome these problems:

- Another DUS testing authority may be asked to perform the necessary disease test(s).

- The applicant / breeder may be requested to carry out a blind disease test with coded samples including the candidate variety and a number of also coded control samples as susceptible and resistant controls.

21. In order to take into account the given points of consideration, the explanation of the disease resistance characteristics, included in the guidelines have to be extended with the necessary information on

- the address(es) where inoculum may be obtained,

- the host differential set of varieties/lines to use to check the inoculum on correctness regarding the races/strains used,

- the address(es) where the differential set may be obtained

- the race/strain specific standard varieties to be included in the test

- the address(es) where the set of standard varieties may be obtained

Annex(I)Terminologyindiseaseresistance**RESISTANCE:**

Ability of a cultivar **to limit the development** of a given pest or pathogen through the whole or a part of a growing cycle.

Several resistance levels may generally be defined .

TOLERANCE:

Ability of a cultivar **to tolerate the development** of a given pest or pathogen whilst displaying disorders that are without serious consequences for its growth, appearance and yield.

Annex(II)Diseaseresistancesinvegetablecrops

Adopted by the Working Group Established by
the ISF Vegetable and Ornamental Section ¹

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For easy reference, amendments and additions to the previous version of the Recommended Codes (version 2.1) are highlighted in yellow

¹ In case of comments, please contact the ISF Secretariat at

Alliums(LeekandOnion)

Scientificname	Englishcommonname	Localcommonname	Code
Viruses:			
LeekYellowStripeVirus	Leekyellowstrip e		LYSV
Fungi:			
<i>Alternariaporri</i>	Purpleblotch		Ap
<i>Botrytisallii(exBotrytisaclada)</i>	Botrytisneckrot		Ba
<i>Botrytissquamosa</i>	Botrytisleafblight		Bs
<i>Fusariumoxysporum f.sp.cepae</i>	Basalrot		Foc
<i>Peronosporadestructor</i>	Downymildew		Pd
<i>Puccinia porri</i>	Rust		Pp
<i>Pyrenochaetaterrestris</i>	Pinkroot		Pt
<i>Sclerotiumcepivorum</i>	Whiterot		Sc

Beans(DwarfFrenchBeanandClimbingFrenchBean)

Scientificname	Englishcommonname	Localcommonname	Code
Viruses:			
BeanCommonMosaicVirus	Beanco mmonmosaic		BCMV
BeanCommonNecroticMosaicVirus	Beancommonnecroticmosaic		BCNMV
BeanGoldenMosaicVirus	Beangoldenmosaic		BGMV
BeanYellowMosaicVirus	Beanyellowmosaic		BYMV
BeetCurlyTopVirus	Beetcurlytop		BCTV
Bacteria:			
<i>Pseudomonassavastanoi pv.phaseolicola</i> (ex <i>Pseudomonassyringae pv.phaseolicola</i>)	Haloblight		Psp
<i>Pseudomonassyringae pv. syringae</i>	Bacterialbrownspot		Pss
<i>Xanthomonasaxonopodis pvphaseoli</i> (ex <i>Xanthomonascampestris pv. phaseoli</i>)	Commonorfuscousblight		Xap
Fungi:			
<i>Aphanomyceseuteiches</i>	Rootrot		Ae
<i>Colletotrichumlindemuthianum</i>	Anthracnose		Cl
<i>Uromycesappendiculatus</i>	Rust		Ua

BottleGourd

Scientificname	Englishcommonname	Localcommonname	Code
Fungi:			
<i>Fusariumoxysporum f.sp. lagenariae</i>	Fusariumwilt		Fol
<i>Fusariumoxysporum f.sp. niveum</i>	Fusariumwilt		Fon

Brassicac(Cabbage,Broccoli,Cauliflower,ChineseCabbage...)

Scientificname	Englishcommonname	Localcommonname	Code
Viruses:			
CauliflowerMosaicVirus	Cauliflowermosaic		CaMV
TurnipMosaicVirus	Turnipmosaic		TuMV
Bacteria:			
<i>Pseudomonassyringae psmaculicola</i>	Pepperyleafspot		Psm
<i>Xanthomonascampestris pv. campestris</i>	Blackrot		Xcc
Fungi:			
<i>Albugocandida</i>	Whiterust		Ac
<i>Albugomacrospora</i>	Whiterust		Am
<i>Alternariabrassicae</i>	Blackleafspot		Abe
<i>Alternariabrassicicola</i>	Blackleafspot		Aba
<i>Erysiphecruciferarum</i>	Powderymildew		Ec
<i>Fusariumoxysporum f.sp. conglutinans</i>	Yellows		Foc
<i>Mycosphaerellabrassicicola</i>	Ringspot		Mb
<i>Peronosporaparasi tica</i>	Downymildew		Pp
<i>Phomalingam</i>	Blackleg		Pl
<i>Plasmodiophorabrassicae</i>	Clubroot		Pb
<i>Verticilliumalbo -atrum</i>	Verticilliumwilt		Va
<i>Verticilliumdahliae</i>	Verticilliumwilt		Vd
<i>Verticilliumlongisporum</i>	Verticilliumwilt		Vl
Insects:			
<i>Plutellaxy lostella</i>	Diamondbackmoth		Px
<i>Tripstabaci</i>	Thrips		Tt

Carrot

Scientificname	Englishcommonname	Localcommonname	Code
Fungi:			
<i>Alternariadauci</i>	Lateleafblight		Ad
<i>Alternariaradicina</i>	Blackrot		Ar
<i>Cercosporacarotae</i>	Earlyleafblight		Cc
<i>Erysipheheraclei</i>	Powderymildew		Eh
<i>Pythiumsulcatum</i>	Cavityspot		Ps
<i>Pythiummultimum</i>	Cavityspot		Pu
<i>Pythiumviolae</i>	Cavityspot		Pv
Insects:			
<i>Psilarosae</i>	Carrotfly		Pr
Nematodes:			
<i>Meloidogyneincognita</i>	Root-knot		Mi
<i>Meloidogynejavanica</i>	Root-knot		Mj

CeleryandCelериac

Scientificname	Englishcommonname	Localcommonname	Code
Viruses:			
CeleryMosaicVirus	Celerymosaic		CeMV
Fungi:			
<i>Fusariumoxysporum</i> f.sp. <i>apii</i>	Fusariumyellowsandwilt		Foa
<i>Septoriaapiicola</i>	Lateblight		Sa

CornSalad

Scientificname	Englishcommonname	Localcommonname	Code
Fungi:			
<i>Perenosporavalerianaella</i>	Downymildew		Pv

Cucumberand PicklingCucumber

Scientificname	Englishcommonname	Localcommonname	Code
Viruses:			
CucumberMosaicVirus	Cucumbermosaic		CMV
CucumberVeinYellowingVirus	Cucumberveinyellowing		CVYV
CucumberYellowingStuntingDisorderVirus	Cucumberyellowing		CYSDV
PapayaRingspotVirus	Papayaringspot		PRSV
WatermelonMosaicVirus	Watermelonmosaic		WMV
ZucchiniYellowMosaicVirus	Zucchiniyellow s		ZYMV
Bacteria:			
<i>Pseudomonassyringae</i> pv. <i>lachrymans</i>	Angularleafspot		Psl
Fungi:			
<i>Cladosporiumcucumerinum</i>	Scabandgummosis		Ccu
<i>Colletotrichumorbiculare</i> (= <i>Colletotrichumlagenarium</i>)	Anthracoise		Co
<i>Corynesporacassicola</i>	Corynesporablighandtargetspot		Cca
<i>Erysiphechichoracearum</i>	Powderymildew		Ec
<i>Fusariumoxysporum</i> f.sp. <i>cucumerinum</i>	Fusariumwilt		Foc
<i>Pseudoperonosporacubensis</i>	Downymildew		Pc
<i>Sphaerothecafuliginea</i>	Powderymildew		Sf

Cucurbitaspp. (Squash,PumpkinandZucchini)

Scientificname	Englishcommonname	Localcommonname	Code
Viruses:			
CucumberMosaicVirus	Cucumbermosaic		CMV
PapayaRingspotVirus	Papayaringspot		PRSV
WatermelonMosaic Virus	Watermelonmosaic		WMV
ZucchiniYellowMosaicVirus	Zucchiniyellows		ZYMV
Fungi:			
<i>Erysiphechichoracearum</i>	Powderymildew		Ec
<i>Fusariumoxysporum</i> f.sp. <i>cucumerinum</i>	Fusariumwilt		Foc
<i>Fusariumoxysporum</i> f.sp. <i>melonis</i>	Fusariumwilt		Fom

<i>Fusariumoxysporum</i> f.sp. <i>niveum</i>	Fusariumwilt		Fon
<i>Fusariumsolani</i> f.sp. <i>cucurbitae</i>	Footandrootrot		Fsc
<i>Sphaerothecafuliginea</i>	Powderymildew		Sf

Eggplant

Scientificname	Englishcommonname	Localcommonname	Code
Bacteria:			
<i>Ralstoniasolanacea rum</i>	Bacterialwilt		Rs
Fungi:			
<i>Fusariumoxysporum</i> f.sp. <i>melongenae</i>	Fusariumwilt		Fom
<i>Verticilliumalbo-atrum</i>	Verticilliumwilt		Va
<i>Verticilliumdahliae</i>	Verticilliumwilt		Vd
Nematodes:			
<i>Meloidogyneincognita</i>	Root-knot		Mi

Lettuce

Scientificname	Englishcommonname	Localcommonname	Code
Viruses:			
BeetWesternYellowsVirus	Yellows		BWYV
CucumberMosaicVirus	Cucumbermosaic		CMV
LettuceBigVeinVirus	Bigvein		LBVV
LettuceMosaicVirus	Lettucemosaic		LMV
TomatoSpottedWilt Virus	Spottedwilt		TSWV
Bacteria:			
<i>Pseudomonascichorii</i>	Bacterialrot		Pc
<i>Rhizomonassuberifaciens</i>	Corkyroot		Rs
<i>Xanthomonascampestris</i> <i>pwitians</i>	Bacterialspot		Xcv
Fungi:			
<i>Bremialactuae</i>	Downymildew		Bl
Insects:			
<i>Macrosiphumeuphorbi ae</i>	Potatoaphid		Me
<i>Myzuspersicae</i>	Greenpeachaphid		Mp
<i>Nasonoviaribismigri</i>	Lettuceleafaphid		Nr
<i>Pemphigusbursarius</i>	Lettucerootaphid		Pb

Melon

Scientificname	Englishcommonname	Localcommonname	Code
Viruses:			
CucumberMosaicVirus	Cucumbermosaic		CMV
MelonNecroticSpotVirus	Melonnecroticspot		MNSV
PapayaRingspotVirus	Papayaringspot		PRSV
WatermelonMosaicVirus	Watermelonmosaic		WMV
ZucchiniYellowMosaicVirus	Zuchiniyellows		ZYMV
Fungi:			
<i>Erysiphecichoracearum</i>	Powderymildew		Ec

<i>Fusariumoxysporum f.sp. melonis</i>	Fusariumwilt		Fom
<i>Pseudoperonosporacubensis</i>	Downymildew		Pc
<i>Sphaerothecafuliginea</i>	Powderymildew		Sf
Insects:			
<i>Aphisgossypii</i>	Cottonaphid		Ag

Peas

Scientificname	Englishcommonname	Localcommonname	Code
Viruses:			
BeanLeafRollVirus	Pealeafrollandpeatopyellows		BLRV
BeanYellowMosaicVirus	Beanyellowmosaic		BYMV
PeaEnationMosaicVirus	Peaenationmosaic		PEMV
PeaSeedborneMosaicVirus	Peaseedbornemosaic		PSbMV
Bacteria:			
<i>Pseudomonassyringae pv.pisi</i>	Bacterialblight		Psp
Fungi:			
<i>Aphanomyceseuteiches</i>	Aphanomycesrootrot		Ae
<i>Ascochytapisi</i>	Ascochytaleafandpodspot		Aps
<i>Ascochytapinodella</i> (= <i>Phomamedicaginis</i> var. <i>Pinodella</i>)	Leafspotandfootrot		Apr
<i>Erysiphepisi</i>	Powderymildew		Ep
<i>Fusariumoxysporum f.sp. pisi</i>	Nearwilt		Fop
<i>Fusariumsolani</i>	Fusariumrootrot		Fs
<i>Mycosphaerellapinodes</i> (=perfectstageof <i>Ascochytapinodes</i>)	Ascochytablight		Mp

Pepper

Scientificname	Englishcommonname	Localcommonname	Code
Viruses:			
BellPepper MottleVirus	Bellpeppermottle		BePMV
CucumberMosaicVirus	Cucumbermosaic		CMV
PepperMidMottleVirus	Peppermidmottle		PMMV
PepperMottleVirus	Peppermottle		PepMoV
PotatoVirusY	PotatovirusY		PVY
TobaccoEtchVirus	Tobaccoetch		TEV
TobaccoMildGreenMosaicVirus	Tobaccomildgreenmosaic		TMGMV
TobaccoMosaicVirus	Tobaccomosaic		TMV
TomatoMosaicVirus	Tomatomosaic		ToMV
TomatoSpottedWiltVirus	Tomatospottedwilt		TSWV
Bacteria:			
<i>Ralstoniasolanacearum</i>	Bacterialwilt		Rs
<i>Xanthomonasvesicatoria</i> (ex <i>Xanthomonascampetris</i> pv. <i>vesicatoria</i>)	Bacterialsplot		Xv
Fungi:			
<i>Fusariumoxysporum f.sp. capsici</i>	Fusariumwilt		Foc
<i>Leveillulataurica</i>	Powderymildew		Lt

<i>Phytophthora capsici</i>	Buckeyefruitandrootrot		Pc
Nematodes:			
<i>Meloidogyne arenaria</i>	Root-knot		Ma
<i>Meloidogyne incognita</i>	Root-knot		Mi
<i>Meloidogyne javanica</i>	Root-knot		Mj

Radish

Scientificname	Englishcommonname	Localcommonname	Code
Viruses:			
TurnipMosaicVirus	Turnipmosaic		TuMV
Bacteria:			
<i>Pseudomonas syringae</i> pv. <i>maculicola</i>	Pepperyleafspot		Psm
Fungi:			
<i>Fusarium oxysporum</i> f.sp. <i>raphani</i>	Yellows		For
<i>Rhizoctonia solana</i>	Rhizoctonia scurf		Rs

Spinach

Scientificname	Englishcommonname	Localcommonname	Code
Viruses:			
CucumberMosaicVirus	Cucumbermosaic		CMV
Fungi:			
<i>Albugo occidentalis</i>	Whiterust		Ao
<i>Cladosporium variabile</i> (= <i>Heterosporium variabile</i>)	Leafmold		Cv
<i>Fusarium oxysporum</i> f.sp. <i>spinaciae</i>	Fusarium wilt		Fos
<i>Peronospora farinosa</i> f.sp. <i>spinaciae</i>	Downymildew		Pfs

SweetCorn

Scientificname	Englishcommonname	Localcommonname	Code
Viruses:			
MaizeDwarfMosaicVirus	Maizedwarfmosaic		MDMV
Bacteria:			
<i>Erwinia stewartii</i>	Stewart's wilt		Es
Fungi:			
<i>Exserohilum turcicum</i> (ex <i>Setosphaeria turcica</i>)	Northern leafblight		Et
<i>Puccinia sorghi</i>	Commonrust		Ps
<i>Ustilago maydis</i>	Commonsmut		Um

Tomato

Scientificname	Englishcommonname	Localcommonname	Code
Viruses:			
CucumberMosaicVirus	Cucumbermosaic		CMV
TomatoSpottedWiltVirus	Spottedwilt		TSWV
TomatoYellowLeafCurlVirus	Tomatoyellowleafcurl		TYLCV
TomatoMosaicVirus	Tomatomosaic		ToMV
Bacteria:			

<i>Clavibactermichiganensis</i> subsp. <i>michiganensis</i>	Bacterialcan ker		Cmm
<i>Pseudomonassyringae</i> pv. <i>tomato</i>	Bacterialspeck		Pst
<i>Ralstoniasolanacearum</i>	Bacterialwilt		Rs
<i>Xanthomonasvesicatoria</i> (ex <i>Xanthomonascampestris</i> pv. <i>vesicatoria</i>)	Bacterialsport		Xv
Fungi:			
<i>Alternariaalternata</i> f.sp. <i>lycopersici</i>	Alternaria stemcanker		Aal
<i>Cladosporiumfulvum</i>	Leafmold		Cf
<i>Fusariumoxysporum</i> f.sp. <i>lycopersici</i>	Fusariumwilt		Fol
<i>Fusariumoxysporum</i> f.sp. <i>radicis-lycopersici</i>	Fusariumcrownandrootrot		For
<i>Leveillulataurica</i>	Powderymildew		Lt
<i>Oidiumlycopersicum</i> (now <i>Oidiumneolycopersici</i>)	Powderymildew		Ol
<i>Phytophthoracapsici</i>	Buckeye fruit and rootrot		Pe
<i>Phytophthorainfestans</i>	Lateblight		Pi
<i>Phytophthora parasitica</i>	Buckeye fruit and rootrot		Pp
<i>Pyrenochaetalycopersici</i>	Corkyrootrot		Pl
<i>Stemphyliumbotryosum</i> f.sp. <i>lycopersici</i>	Grayleafspot		Sbl
<i>Stemphyliumfloridanum</i>	Grayleafspot		Sf
<i>Stemphylium solani</i>	Grayleafspot		Ss
<i>Verticillium albo-atrum</i>	Verticilliumwilt		Va
<i>Verticilliumdahliae</i>	Verticilliumwilt		Vd
Nematodes:			
<i>Meloidogynearenaria</i>	Root-knot		Ma
<i>Meloidogyneincognita</i>	Root-knot		Mi
<i>Meloidogynejavanica</i>	Root-knot		Mj

Watermelon

Scientificname	Englishcommonname	Localcommonname	Code
Fungi:			
<i>Colletotrichumlagenarium</i>	Anthraxnose		Cl
<i>Fusariumoxysporum</i> f.sp. <i>niveum</i>	Fusariumwilt		Fon
<i>Sphaerothecafuliginea</i>	Powderymildew		Sf

WaxGourd

Scientificname	Englishcommonname	Localcommonname	Code
Fungi:			
<i>Fusariumoxysporum</i> f.sp. <i>lagenariae</i>	Fusariumwilt		Fol
<i>Fusariumoxysporum</i> f.sp. <i>niveum</i>	Fusariumwilt		Fon

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