Gene List for Other Genera of Cucurbitaceae 2008

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Introduction

The Cucurbitaceae includes many important vegetables species, including cucumber, melon and watermelon. Those are major crop species originally from the Old World: cucumber from India; melon and watermelon from Africa (Wehner and Maynard, 2003). However, there are other important species originally from Africa such as gherkin (*Cucumis anguria*), African horned melon (*Cucumis metuliferus*), bottle gourd (*Lagenaria siceraria*); and species originally from India such as sponge gourd (*Luffa* spp.), *Melothria* (*Melothria medraspatana*) and bitter melon (*Momordica charantia*). They have fruit that are used for food, decoration, containers, utensils or sponges. The exception is *Melothria*, which has medicinal uses (Iman et al., 2006).

Gene List Update

The following list is the latest version of the gene list for the miscellaneous species and genera of the Cucurbitaceae. The genes originally were organized and summarized by Robinson (1979, 1982). This current gene list provides an update of the known genes, with 20 total mutants grouped by species.

Researchers are encouraged to send reports of new genes, as well as seed samples of lines having the gene mutant to the gene curator (Mark G. Hutton), or the assistant curator (Thomas C. Andres). Please inform us of omissions or errors in the gene list. Scientists should consult the list as well as the rules of gene nomenclature for the Cucurbitaceae (Cucurbit Gene List Committee, 1982; Robinson et al., 1976) before choosing a gene name and symbol. Please choose a gene name and symbol with the fewest characters that describes the recessive mutant, and avoid use of duplicate gene names and symbols. The rules of gene nomenclature were adopted in order to provide guidelines for naming and symbolizing genes. Scientists are urged to contact members of the gene list committee regarding rules and gene symbols. The gene curators for other genera of the Cucurbit Genetics Cooperative are collecting seeds of the type lines for use by interested researchers, and would like to receive seed samples of any of the lines listed.

This gene list has been modified from previous lists in that we have expanded the gene descriptions of the phenotypes of the gene mutants, and added genes not previously described: *Bt, S* and *P* (*Cucumis anguria*), *Prsv* (*Cucumis metuliferus*), *S* (*Lagenaria siceraria*), and *gy-1* (*Momordica charantia*).

Previous Gene Lists

- Robinson, 1979: 13 genes added, 13 genes total
- Robinson, 1982: 1 gene added, 14 genes total

West Indian Gherkin (*Cucumis anguria)*

Four gene loci have been described so far for West Indian gherkin. A single dominant gene produces bitter fruit: *Bt* (Koch and Costa, 1991). Another dominant gene controls resistance to Cucumber green mottle mosaic virus: *Cgm* (den Nijs, 1982). Two loci control fruit spininess: *S and P* (Koch and Costa, 1991).

African horned cucumber (*Cucumis metuliferus*)

Watermelon mosaic virus-1 resistance is controlled by a single dominant gene *Wmv* (Provvidenti and Robinson, 1972). Another single dominant gene, *Prsv* controlled resistance to Papaya ringspot virus (Provvidenti and Gonsalves, 1982). The resistant type line was PI 292190, and the susceptible type line was Acc. 2459.

Bottle Gourd (*Lagenaria siceraria*)

Red pumpkin beetle (*Aulacophora faveicollis*) resistance is controlled by a single dominant gene *Af* (Vashishta and Choudhury, 1972). Different genes affect shape and color of the fruit in bottle gourd. The genotype *bb* produces bottle-shaped fruit, and *BB* produces disk-shaped fruit. The genotype *rr* produces round fruit shape that is also recessive to the genotype *RR*, with disk-shaped fruit. The gene *db* interacts with *b* to produce an F2 of 9 club: 3 round: 4 dumbbell-shaped fruit (Tyagi, 1976). Dark green fruit color is controlled by the genotype *GG* which is dominant to the genotype *gg* with light green fruit color (Tyagi, 1976). The genotype *lb lb*

controls the light brown seed coat color, but it is recessive to the genotype *Lb Lb* with brown seed coat color (Tyagi, 1976).

Four normal-leaf parents (Pusa Naveen, PBOG 13, PBOG 22 and PBOG 61) were crossed with segmented-leaf parents (PBOG 54) of bottle gourd to study the inheritance of segmented leaf shape. Normal leaf shape parents showed true breeding normal leaf type plants. However, the segmented-leaf parent (PBOG 54) surprisingly segregated in a ratio of 3 segmented: 1 normal leaf shape plants. Moreover, FIS also segregated in 1 segmented: 1 normal leaf shape suggesting that the parental cultivar PBOG 54 was heterozygous for leaf shape *gene* and the segmented leaf was dominant over normal type. The segregation in the backcrosses in to 1 segmented: 1 normal leaf type confirmed that a single dominant *gene S* is responsible for segmented leaf shape character in bottle gourd (Akhilesh and Ram, 2006).

Luffa Sponge Gourd (Smooth Luffa) (*Luffa aegyptiaca*), Luffa Ridge Gourd (Angled Luffa) (*L. acutangula*)

The gynoecious gene *g* (Choudhury and Thakur, 1965) interacts with andromonoecious gene *a* to produce the following phenotypes: monecious or trimonoecious (*AA GG*), andromonoecious (*aa GG*), gynoecious (*AA gg*), or hermaphroditic (*aa gg*) plants.

Melothria (*Melothria medraspatana*)

Small seed size (3.0 mm) is controlled by the gene *s* (Sing, 1972) that is recessive to *SS* for large seed size (3.6 mm). The gene *w* controls the white seed coat color if *ww*, if *Ww* it the color will be ashy, and black if *WW* (Sing, 1972).

Bitter Melon (*Momordica charantia*)

Light brown seed *lbs* (Ram et al., 2006) is inherited as a single gene that is recessive to dark brown. Large seed size is controlled by the gene *ls*, which is recessive to small seed size (Srivastava and Nath, 1972). White immature fruit skin is controlled by the genotype *ww* for white epicarp that is recessive to the genotype *WW* for green epicarp (Srivastava and Nath, 1972).

Ram et al. (2006) reported that gynoecism in Gy263B was controlled by a single recessive gene *gy-1*. The gynoecious plants of Gy263B had significantly longer (200 cm) vine length than their monoecious counterparts (127.5 cm).

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Table 1. The morphological and resistance genes of the miscellaneous genera and species of the Cucurbitaceae,

Symbol	Gene description and type lines	References
Cucumis anguria		
Bt	*Bitter fruit.* Fruit with bitter flavor due to a single dominant gene determined in the segregating populations of *Cucumis anguria x C. longipes*.	Koch and Costa, 1991
Cgm	*Cucumber green mottle resistance.*	den Nijs, 1982
S	*Spine fruit*. The fruit spininess is determined in the segregating populations of *Cucumis anguria x C. longipes*. by two pairs of independent genes.	Koch and Costa, 1991
P	*Spine fruit.* The fruit spininess is determined in the segregating populations of *Cucumis anguria x C. longipes*. by two pairs of independent genes.	Koch and Costa, 1991
Cucumis metuliferus		
Prsv	*Papaya ringspot virus resistance. Resistance to papaya ringspot virus; dominant to susceptibility.*	Provvident and Gonsalves, 1982
Wmv	*Watermelon mosaic virus resistance.* Resistance to watermelon virus-1; dominant to susceptibility.	Provvidenti and Robinson, 1972
Lagenaria siceraria		
Af	*Aulacophora foveicollis resistance.* Resistance dominant to susceptibility to the red pumpkin beetle.	Vashishta and Choudhury, 1972
b	*bottle.* Bottle-shaped fruit recessive to disk.	Tyagi, 1976
db	*dumbbell*. Interacts with b to produce F2 of 9 club: 3 round: 4 dumbbell-shaped fruit.	Tyagi, 1976
G	*Green.* Dark green fruit color; dominant to light green.	Tyagi, 1976
lb	*light brown seed*. Light brown seed coat color recessive to brown.	Tyagi, 1976
r	*round.* Round fruit; recessive to disk fruit shape.	Tyagi, 1976
S	*Segmented leaves.* A single dominant gene which is responsible for segmented leaf shape in bottle gourd from PBOG 54 (heterozygous for segmented leaf shape).	Akhilesh and Ram, 2006
***Luffa* spp.**		
g	*gynoecious.* Pistillate flowers only; interacts with a to produce monoecious or trimonoecious (*AA GG*), andromonoecious (*aa GG*), gynoecious (*AA gg*), or hermaphroditic (*aa gg*) plants.	Choudhury and Thakur, 1965
Melothria medraspatana		
s	*small seeds.* Small (3.0 mm) seed recessive to large (3.6 mm).	Sing, 1972
w	*white seeds.* White seed coat if *ww*, ashy if *Ww*, and black if *WW*.	Sing, 1972
Momordica charantia		
gy-1	*gynoecious* Recessive gene for high degree of pistillate sex expression from Gy263B (100% gynoecious line).	Ram et al., 2006
lbs	*light brown seed.* Light brown seed coat color; recessive to dark brown.	Srivastava and Nath, 1972
ls	*large seed.* Large seed size; recessive to small seed size.	Srivastava and Nath, 1972
w	*white epicarp*. White immature fruit skin; recessive to green.	Srivastava and Nath, 1972