

IV. Proposal

Suggested guidelines for the nomenclature and abbreviation of the genetic stocks of wheat, *Triticum aestivum* L. em Thell., and its relatives¹

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¹ This is contribution 95-541-J from the Kansas Agricultural Experiment Station, Manhattan.

The current nomenclature for describing the aneuploids of common wheat was introduced by Sears in 1954 and described in detail by Kimber and Sears in 1968. This nomenclature can be lengthy, and its use in manuscripts and descriptive figures cumbersome. Additionally, the needs of computerized databases require a shortening of these terms to save time and storage space. The ability to search lists of stocks suggests the need for succinct, descriptive abbreviations for the genetic stocks in wheat. GrainGenes, the wheat genome database, is no exception as search criteria can yield several screens of data. The purpose of this communication is to provide a list of recommended abbreviations for the aneuploid lines and genetic stocks in wheat.

Several recommended guidelines presented by Kimber and Sears (1968) will be used. These include designating:

- i) telocentric chromosomes with the letter "t",
- ii) isochromosomes with the letter "i",
- iii) the ability of chromosomes to pair with superscripts following the chromosome symbols. The actual pairing may vary considerably from cell to cell. The idealized pairing configuration is indicated in all cases even though it may rarely form,
- iv) chromosome status shown by the chromosome number followed by symbols indicating the configuration,
- v) chromosome arms by S (genetically short) or L (genetically long), and
- vi) substituted chromosomes by the homoeologous group number and genome designation. The designation of the chromosome that was replaced follows in parentheses.

Publications by Gill (1986) and Gill et al. (1991) added additional descriptors for wheat genetic stocks. The symbols were based on suggestions by the Chicago (1966) and Paris Conferences (1971) for Standardization in Human Cytogenetics. Where applicable, these conventions will also be used:

- vii) single and three letter designations specify rearranged chromosomes, such as "del" for deletion and "r" for ring chromosome,

- viii) the short system for defining translocation lines includes only the break points and the following punctuation: "." indicates a break at the centromere, a dash "-", indicates an interstitial breakpoint, and a slash "/" indicates an unknown breakpoint,
- ix) the detailed system describes translocation lines by defining their band composition and the additional symbols, ":" break (terminal deletion), "::" break and join, and
- x) a translocation chromosome is indicated by a "T" preceding a description of the translocation.

Further descriptions of translocated chromosomes are given in Gill et al. (1991) and will be described as needed.

A brief survey of the literature published in the proceedings of the International Wheat Genetics Symposia (I through VII), as well as later issues of the journal GENOME, indicate that the choice of terminology is left to the authors. However, it seems that over time, some conventions were standardized. These are the designation of:

- xi) nullisomic lines with an "N" followed by the designated chromosome and genome,
- xii) monosomic lines with an "M" followed by the designated chromosome and genome,
- xiii) the disomic condition with a "D" followed by the designated chromosome and genome,
- xiv) the trisomic condition with "Tri" followed by the designated chromosome and genome,
- xv) tetrasomic lines with a "T" followed by the designated chromosome and genome. A "T" is also the designator for translocation lines to be consistent with current literature,
- xvi) nullisomic-tetrasomic lines with an "N" followed by the number and genome of the nullisomic chromosome and a "T" followed by the same for the tetrasomic chromosome, as in N1A T1B,
- xvii) monosomic and disomic additions by "MA" and "DA", respectively, and
- xviii) monosomic and disomic substitutions as "MS" and "DS", respectively, followed by chromosome designation as indicated in rule vi, and
- xix) abbreviations for wheat cultivars according to "Wheat Cultivar Abbreviations" 1985, Special Report 749, Agricultural Experiment Station, Oregon State University, Corvallis. This publication is currently under revision by CIMMYT.

Rules of hierarchy, established to ensure consistency in the naming of stocks, include that: xx) the short arm is listed before the long arm, xxi) the monosomic condition (either for the whole chromosome, chromosome arms, or parts thereof) is listed before the disomic condition except in cases where it is superceded by rule xxii, xxii) telosomic chromosomes are listed before isosomic chromosomes, xxiii) in translocation chromosomes, the common wheat chromosome regardless of arm, is listed before the alien chromosome segment, and xxiv) in translocation chromosomes between two alien chromosomes where the breakpoint is unknown, the order is according to homoeologous group.

Some stocks require abbreviations or symbols that were previously neither required nor based on the guidelines presented here. These include:

- xxv) "Mt" and "Dt" indicate monotel- and ditelosomic lines following rules i (for telochromosomes), xii, and xiii,
- xxvi) the doubled condition is indicated with a "d" followed by the designated chromosome and genome, and
- xxvii) the number sign "#" is used to distinguish different chromosomes belonging to the same homoeologous group of chromosomes within accessions, between accessions of the same nondomesticated species, or between homologous chromosomes within a cultivar.

Finally, certain symbols for use in computer databases, where some text styles are not available, include that:

- xxviii) the symbol "^" encloses characters to be supercripted, and xxix) the symbol "`" encloses characters to be subscripted.

The following is a list of each aneuploid type or genetic stock, with an example of how the data would be displayed in each of the GrainGenes model fields for germplasm. For simplicity, chromosome 1A of wheat is used along with a homoeologue in rye (*Secale cereale*) or *Triticum longissimum* where needed. All of the chromosome stocks are represented to appear in the cultivar "Chinese Spring", hereafter designated by the

abbreviation CS. The first column lists the variable name from the GrainGenes germplasm model (see Appendix I for a list of all variables available in this model). The second column lists the actual data that will appear in the database next to the variable name. Chromosome configuration is included with respect to item iii above Finally, a comment is included where required.

NULLISOMIC N

Germplasm: Chinese Spring Nullisomic 1A
 Abbreviation: CS N1A
 Species: *Triticum aestivum*
 Type: Aneuploid
 Derived_from: Chinese Spring
 Chromosome_configuration: 20"+0'1A
 Chromoeome_number: 40

MONOSOMIC M

Germplasm: Chinese Spring Monosomic 1A
 Abbreviation: CS M1A
 Species: *Triticum aestivum*
 Type: Aneuploid
 Derived_from: Chinese Spring
 Chromosome_configuration: 20"+1'1A
 Chromoeome_number: 41

TRISOMIC Tri

Germplasm: Chinese Spring Trisomic 1A
 Abbreviation: CS Tri1A
 Species: *Triticum aestivum*
 Type: Aneuploid
 Derived_from: Chinese Spring
 Chromosome_configuration: 20"+1'''1A
 Chromoeome_number: 43
 Comment: The abbreviation "Tri" was selected because the letter " T " already indicates tetrasomy and translocation lines. The other choice "Tr" might cause confusion with translocation line nomenclature.

TETRASOMIC T

Germplasm: Chinese Spring Tetrasomic 1A
 Abbreviation: CS T1A
 Species: *Triticum aestivum*
 Type: Aneuploid
 Derived_from: Chinese Spring
 Chromosome_configuration: 20"+1''''1A
 Chromoeome_number: 44

NULLISOMIC-TETRASOMIC NT

Germplasm: Chinese Spring Nullisomic 1B-Tetrasomic 1A
 Abbreviation: CS N1B-T1A
 Species: *Triticum aestivum*
 Type: Aneuploid
 Derived_from: Chinese Spring
 Chromosome_configuration: 19"+1''''1A(1B)
 Chromoeome_number: 42
 Comment: Using rule vi, this could be abbreviated "CS NT1B(1A)", but we believe the above to be more easily read.

MONOTELOSOMIC Mt

Germplasm: Chinese Spring Monotelosomic 1AS
Abbreviation: CS Mt1AS
Species: *Triticum aestivum*
Type: Aneuploid
Derived_from: Chinese Spring
Chromosome_configuration: 20"+t'1AS
Chromosome_number: 41t

DITELOSOMIC Dt

Germplasm: Chinese Spring Ditelosomic 1AS
Abbreviation: CS Dt1AS
Species: *Triticum aestivum*
Type: Aneuploid
Derived_from: Chinese Spring
Chromosome_configuration: 20"+t"1AS
Chromosome_number: 42tt

DOUBLE MONOTELOSOMIC dMt

Germplasm: Chinese Spring Double Monotelosomic 1A
Abbreviation: CS Mt1AS-Mt1AL
Species: *Triticum aestivum*
Type: Aneuploid
Derived_from: Chinese Spring
Chromosome_configuration: 20"+t'1AS+t'1AL
Chromosome_number: 42t+t
Comment: The use of a "+" in the chromosome_number field will distinguish this line from ditelosomic lines since both lines have two telochromosomes.

DOUBLE DITELOSOMIC dDt

Germplasm: Chinese Spring Double Ditelosomic 1A
Abbreviation: CS dDt1A
Species: *Triticum aestivum*
Type: Aneuploid
Derived_from: Chinese Spring
Chromosome_configuration: 20"+t"1AS+t"1AL
Chromosome_number: 44tt+tt

DITELO-MONOTELOSOMIC DtMt

Germplasm: Chinese Spring Ditelosomic1AS-Monotelosomic 1AL
Abbreviation: CS Dt1AS-Mt1AL
Species: *Triticum aestivum*
Type: Aneuploid
Derived_from: Chinese Spring
Chromosome_configuration: 20"+t"1AS+t'1AL
Chromosome_number: 43tt+t
Comment: The ditelosomic chromosome is listed first regardless of arm, thus the abbreviation for the line ditelosomic 1AL-monotelosomic 1AS lists the long arm first.

MONO-ISOSOMIC Mi

Germplasm: Chinese Spring Mono-isosomic 1AS
Abbreviation: CS Mi1AS
Species: *Triticum aestivum*

Type:
Derived_from:
Chromosome_configuration:
Chromoeome_number:

Aneuploid
Chinese Spring
20"+i"1AS
41i

DI-ISOSOMIC Di

Germplasm:
Abbreviation:
Species:
Type:
Derived_from:
Chromosome_configuration:
Chromoeome_number:

Chinese Spring Di-isoeomic 1AS
CS Di1AS
Triticum aestivum
Aneuploid
Chinese Spring
20"+i"1AS
42ii

MONOSOMIC ADDITION MA

Germplasm:
Abbreviation:
Species:
Donor_species:
Type:
Derived_from:
Chromosome_configuration:
Chromoeome_number:
Comment:

Chinese Spring-Imperial Monosomic Addition 1R
CS-I MA1R
Triticum aestivum
Secale cereale cv. Imperial
Aneuploid
Chinese Spring
21"+1"1R
43
Where duplicate lines from the same cultivar are available, it may be necessary to add a number or symbol to distinguish them.

DISOMIC ADDITION DA

Germplasm:
Abbreviation:
Species:
Donor-species:
Type:
Derived_from:
Chromosome_configuration:
Chromoeome_number:

Chinese Spring-Imperial Disomic Addition 1R
CS-I DA1R
Triticum aestivum
Secale cereale cv. Imperial
Aneuploid
Chinese Spring
21"+1"1R
44

Germplasm:
Abbreviation:
Species:
Donor_species:
Donor_ID:
Type:
Derived_from:
Chromosome_configuration:
Chromosome_number:
Developed_by:
Development-site:
Comment:

Chinese, Spring- *T. longissimum* Disomic Addition 1S¹¹
CS-TLON DA1S¹¹
Triticum aestivum
T. longissimum
exas A&M, accession, #2
Aneuploid
Chinese Spring
21"+1"1S¹¹
44
N. A. Tuleen
Texas A&M University, College Station
The genome for *T. longissimum* is S superscript "I".

MONOSOMIC SUBSTITUTION MS

Germplasm:
Abbreviation:
Species:
Donor_species:
Type:

Chinese Spring-Imperial Monosomic Substitution 1R(1A)
CS-I MS1R(1A)
Triticum aestivum
Secale cereale cv. Imperial
Substitution

Derived_from: Chinese Spring
 Chromosome_configuration: 20"+1"1R(1A)
 Chromoeome_number: 41

DISOMIC SUBSTITUTION DS

Germplasm: Chinese Spring-ImperialDisomic Substitution 1R(1A)
 Abbreviation: CS-I DS1R(1A)
 Species: *Triticum aestivum*
 Donor_species: *Secale cereale* cv. Imperial
 Type: Substitution
 Derived_from: Chinese Spring
 Chromosome_configuration: 20"+1"1R(1A)
 Chromoeome_number: 42

INTERVARIETAL DISOMIC SUBSTITUTION DS

Germplasm: ChineseSpring-Wichita DisomicSubstitution 1A WI(1A CS)
 Abbreviation: CS-WI DS1A
 Species: *Triticum aestivum*
 Type: Substitution
 Donor_species: Wichita
 Derived_from: Chinese Spring
 Chromosome_configuration: 20"+1"1AWI(1A CS)
 Chromoeome_number: 42
 Comment: The substituting chromosome is part of the name, the substituting chromosome named in parentheses. For abbreviations, when cultivars substitute same chromosome, it need only be listed once.

TRANSLOCATION CHROMOSOMES T

TERMINAL TRANSLOCATION WITH CENTROMERIC BREAKPOINT

Germplasm: ChineseSpring-ImperialTranslocation T1AS·1RL
 Abbreviation: CS-I T1AS·1RL
 Species: *Triticum aestivum*
 Donor_species: *Secale cereale* cv. Imperial
 Type: Tranelocation
 Translocation_description: Terminaltranslocation with centromeric breakpoint
 Derived_from: Chinese Spring
 Chromosome_configuration: 20"+1"T1AS·1RL
 Chromoeome_number: 42
 Comment: · indicates a break at the centromere. In the example above, the translocation chromosome consists of the short arm of chromosome 1A translocated to the long arm of 1R with the breakpoint at the centromere.

The following example is of an actual translocation line of this type and is how it appears in GrainGenes.

Germplasm: Chinese Spring-*A. intermedium* Translocation T4DL·4Ai#2S
 Abbreviation: CS-AGAI T4DL·4Ai#2S
 Species: *Triticum aestivum*
 Donor_species: *Agropyron intermedium*
 Type: Translocation
 Translocatin_description: Terminal tranalocation with centromeric breakpoint
 Derived_from: Chinese Spring
 Chromosome_configuration: 20"+1"T4DL·4Ai#2S
 Chromoeome_number: 42
 Developed-by: D. Wells
 Development_site: South Dakota State University, Brookings

Comment: The number sign (#) is used to distinguish between different chromosomes belonging to the same homoeologous group of chromosomes within accessions, as well as between accessions of the same species or cultivar. In this example, the long arm of *T. aestivum* chromosome 4D (4DL) is translocated with a centromeric breakpoint (·) to the short arm (S) of an *A. intermedium* chromosome (4Ai#2S)

TERMINAL TRANSLOCATION WITH NON- CENTROMERIC BREAKPOINT

Germplasm: Chinese Spring-Imperial Translocation T1AS·1AL-1RL
 Abbreviation: CS-I T1AS·1ALARL
 Species: *Triticum aestivum*
 Donor_species: *Secale cereale* cv. Imperial
 Type: Translocation
 Translocation_description: Terminal translocation with non-centromeric breakpoint
 Derived_from: Chinese Spring
 Chromosome_configuration: 20"+1"T1AS·1AL-1RL
 Detailed_abbreviation: CS-I1AS·1AL1.4::1.21RL
 Chromosome_number : 42
 Comment: - and :: indicate a break and rejoining within the arm. In the example above, the translocation chromosome consists of the short arm of wheat chromosome 1A, a segment of the long arm of 1A with the breakpoint in band 1AL1.4 and a distal segment derived from 1RL with the breakpoint in band 1RL1.2.

INTERCALARY TRANSLOCATION WITH NON-CENTROMERIC BREAKPOINT

Germplasm: Chinese Spring-Imperial Translocation Ti4AS·4AL-6RL-4AL
 Abbreviation: CS-I Ti4AS·4AL-6RL-4AL
 Species: *Triticum aestivum*
 Donor_species: *Secale cereale* cv. Imperial
 Type: Translocation
 Translocation_description: Intercalary translocation with non-centromeric breakpoint
 Derived_from: Chinese Spring
 Chromosome_configuration: 20"+1"Ti4AS·4AL-6RL-4AL
 Detailed_abbreviation: CS-I Ti4AS4·AL1.2::6RL-2.7::4AL
 Chromosome_number : 42
 Comment: Ti = an intercalary translocation.

TRANSLOCATION WITH UNKNOWN BREAKPOINT

Germplasm: *Triticum araraticum* Translocation T4G/5G
 Abbreviation: CS-TARA T4G/5G
 Species: *Triticum aestivum*
 Donor_species: *Triticum araraticum*
 Type: Translocation
 Translocation_description: Translocation with unknown breakpoint
 Derived_from: Chinese Spring
 Chromosome_configuration: 20"+1"T4G/5G
 Chromosome_number : 42
 Comment: / = unknown breakpoint

DELETION CHROMOSOMES del

Germplasm: Chinese Spring Deletion 1AS-1
 Abbreviation: CS del1AS-1
 Species: *Triticum aestivum*

Type:	Deletion
Derived_from:	Chinese Spring
Chromosome_configuration:	20"+1"del1AS-1
Detailed_abbreviation:	CS del1AS-1 (S1.2, 0.17:)
Chromosome_number :	42
Comment:	: = terminal deletion. Numbers in detailed abbreviation indicate C-band where deletion occurs and fraction length of chromosome remaining.

References

- Gill BS (1986) A proposal for wheat chromosome band nomenclature. In: North American Wheat Genetic Mapping and Cytogenetic Stocks Workshop, April 17-19, 1986, University of Missouri, Columbia. Ed: Qualset CO and McGuire PE. The National Association of Wheat Growers Foundation, Washington, D.C. 11-15.
- Gill BS, Friebe B, and Endo TR (1991) Standard karyotype and nomenclature system for description of chromosome bands and structural aberrations in wheat (*Triticum aestivum*). *Genome* 34: 830 - 839.
- Kimber G and Sears ER (1968) Nomenclature for the description of aneuploids in the Triticinae. In: Proc 3rd Int Wheat Genet Symp, Ed: Findlay KW and Shepherd KW. Canberra, Australia. 468-473.
- Sears ER (1954) The aneuploids of common wheat. *Research Bull.* 572, Missouri Ag. Exp. Sta. 57 p.

APPENDIX I. GrainGenes ?Germplasm model

The following fields are currently available for use in the germplasm model for the description of genetic stocks.

?Germplasm
 Other_name ?Germplasm XREF Other_name // Put data in only one.
 Species UNIQUE ?Species
 Donor_species ?Species //For addition chromosomes
 Type #Germplasm_type
 Collection_and_ID ?Collection ?Germplasm XREF Other_name
 Cross_number ?Text //Identifier used by CIMMYT
 Chromosome_configuration ?Text
 Abbreviation ?Germplasm XREF Full_name
 Full_name ?Germplasm XREF Abbreviation
 Pairing_configuration ?Text
 Chromosome_number ?Text //Not Int. "42tt" = ditelosomic substn.
 Female_Parent UNIQUE ?Germplasm
 Male_Parent UNIQUE ?Germplasm
 Pedigree UNIQUE ?Text
 Market_Class ?Text
 Trait_study ?Trait_Study
 Pathology ?Pathology XREF Resistant_line
 Allele ?Allele //No XREF
 Gene ?Gene //No XREF
 Rearrangement ?Rearrangement XREF Germplasm
 Derived_from ?Germplasm
 Developed_by ?Text
 Development_site ?Text
 Date_of_release ?Text
 Registration_No ?Text
 Remark ?Text

Reference ?Reference XREF Germplasm
Mapping_data ?Map_Data
Image ?Image XREF Germplasm
Data_source ?Colleague ?Text //Text is date, e.g. 93.08.27
Polymorphism ?Polymorphism
Trait_scores ?Trait_scores//could be a long list.
Coefficient_of_parentage ?Germplasm Float //Must be at end of
//model; this could be a Long list.