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INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

DRAFT

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/14

"GLOSSARY OF [a] ~~TECHNICAL, BOTANICAL AND STATISTICAL~~ TERMS USED IN UPOV DOCUMENTS"

Document prepared by the Office of the Union

to be considered by the Technical Committee at its forty-fifth session,
to be held in Geneva from March 30 to April 1, 2009

Note for Draft version

~~**Strikethrough**~~ **(highlighted)** indicates deletion from the text presented to the Technical Committee (TC) at its forty-fourth session

Underlining (highlighted) indicates insertion to the text presented to the TC at its forty-fourth session

Highlighted text indicates text which cannot yet be completed

Red font indicates term included in index

Footnotes will be retained in published document

Endnotes are for background information when considering this draft and will not appear in the final, published document

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SECTION 1. INSTITUTIONAL AND TECHNICAL TERMS

Additional characteristic	The General Introduction states in Chapter 4.2.3 that "The characteristics included in the individual Test Guidelines are not necessarily exhaustive and may be expanded with *additional characteristics* if that proves to be useful and the characteristics meet the conditions set out [in Chapter 4.2.1]". It further clarifies in Chapter 4.8, "Functional Categorization of Characteristics" that the function of *additional characteristics* is: "1. To identify new characteristics, not included in the Test Guidelines, that have been used by members of the Union in the examination of DUS and which should be considered for inclusion in future Test Guidelines"; and "2. To facilitate harmonization in the development and use of new characteristics and provide opportunity for expert review."
Additional Standard Wording (Test Guidelines)	In addition to the TG Template, further guidance is provided for drafters of Test Guidelines on how to develop individual Test Guidelines from the TG Template. This is provided by means of *additional standard wording* (ASW) and guidance notes (GN) and indications are provided within the TG Template on where this further guidance is available. (see document TGP/7 "Development of Test Guidelines": Section 3.2).
Additional test	An *additional test* is a test for examining relevant characteristics which is carried out in addition to the DUS growing trial. (see TGP/7 "Development of Test Guidelines", Annex I: TG Template, Chapter 3.6)
Administrative and Legal Committee	UPOV Administrative and Legal Committee (abbreviated to "CAJ") (see "[…]" website reference to be provided)
Asterisked characteristic	*Asterisked characteristics* (denoted by *) are those included in the Test Guidelines which are important for the international harmonization of variety descriptions and should always be examined for DUS and included in the variety description by all members of the Union, except when the state of expression of a preceding characteristic or regional environmental conditions render this inappropriate. (General Introduction, Chapter 4.8)
ASW (Test Guidelines)	abbreviation of "Additional Standard Wording" (see above)
Atypical plant	*see General Introduction, Chapter 6.4 "Methods for the Examination of Uniformity" and Chapter 6.5 "Unrelated and Very Atypical Plants"; and TGP/10/1 Section 4.2.2 "Guidance for determining Off-types", Section 4.2.3 "Investigating plants with atypical expression" and Section 4.6 "Plants which are not considered as Off-types"*
Authority	"authority" means the authority entrusted with the task of granting breeders' rights (see Article 30(1)(ii)of the 1991 Act of UPOV Convention)
BMT	abbreviation of "*UPOV Working Group on Biochemical and Molecular Techniques, and DNA-Profiling in Particular" (see "[…]" website reference to be provided)*

Breeder	Article 1(iv) of the 1991 Act states that: ""breeder" means - the person who bred, or discovered and developed, a variety, - the person who is the employer of the aforementioned person or who has commissioned the latter's work, where the laws of the relevant Contracting Party so provide, or - the successor in title of the first or second aforementioned person, as the case may be"
Breeder's Right	"breeder's right" means the right of the breeder provided for in the UPOV Convention. Synonymous with "plant breeder's right". (see Article 1(v)of the 1991 Act of UPOV Convention)
Characteristic	The General Introduction states the following: "4.2.1 The basic requirements that a characteristic should fulfill before it is used for DUS testing or producing a variety description are that its expression: (a) results from a given genotype or combination of genotypes (this requirement is specified in Article 1(vi) of the 1991 Act of the UPOV Convention but is a basic requirement in all cases); (b) is sufficiently consistent and repeatable in a particular environment; (c) exhibits sufficient variation between varieties to be able to establish distinctness; (d) is capable of precise definition and recognition (this requirement is specified in Article 6 of the 1961/1972 and 1978 Acts of the UPOV Convention, but is a basic requirement in all cases); (e) allows uniformity requirements to be fulfilled; (f) allows stability requirements to be fulfilled, meaning that it produces consistent and repeatable results after repeated propagation or, where appropriate, at the end of each cycle of propagation." "4.2.2 It should be noted that there is no requirement for a characteristic to have any intrinsic commercial value or merit. However, if a characteristic that is of commercial value or merit satisfies all the criteria for inclusion it may be considered in the normal way." "4.2.3 For inclusion in the Test Guidelines, further criteria are set out in [the General Introduction] section 4.8, "Functional Categorization of Characteristics" and in document TGP/7, "Development of Test Guidelines." The characteristics included in the individual Test Guidelines are not necessarily exhaustive and may be expanded with additional characteristics if that proves to be useful and the characteristics meet the conditions set out above."
CAJ	abbreviation of "*UPOV Administrative and Legal Committee*" *(see "[…]" website reference to be provided)*
CC	abbreviation of "*Consultative Committee of UPOV*" *(see "[…]" website reference to be provided)*
Combined characteristic	A *combined characteristic* is a simple combination of a small number of characteristics. Provided the combination is biologically meaningful, characteristics that are assessed separately may subsequently be combined, for example the ratio of length to width, to produce such a combined

	characteristic. Combined characteristics must be examined for distinctness, uniformity and stability to the same extent as other characteristics. Combined characteristics are not to be confused with the application of methods, such as "multivariate analysis." (see General Introduction, Chapter 4.6.3)
Consultative Committee	*"Consultative Committee of UPOV" (see "[…]" website reference to be provided)*
Contracting Party	State or Intergovernmental Organization party to the 1991 Act
Convention	International Convention for the Protection of New Varieties of Plants
Council	*Council of UPOV (see "[…]" website reference to be provided)*
Distinct / Distinctness	Article 7 "*Distinctness*" of the 1991 Act states: "The variety shall be deemed to be distinct if it is clearly distinguishable from any other variety whose existence is a matter of common knowledge at the time of the filing of the application. In particular, the filing of an application for the granting of a breeder's right or for the entering of another variety in an official register of varieties, in any country, shall be deemed to render that other variety a matter of common knowledge from the date of the application, provided that the application leads to the granting of a breeder's right or to the entering of the said other variety in the official register of varieties, as the case may be."
Drafter's Kit for Test Guidelines	A collection of guidance and information documents provided on the UPOV website for drafters of Test Guidelines (*http://www.upov.int/restrict/en/index_drafters_kit.htm*)
Drilled plot	A drilled plot is one in which seed is planted with a machine which does not place the seed individually. Compare to "Spaced plant plot/trial"
DUS	abbreviation of Distinctness, Uniformity and Stability
DUS test	examination of Distinctness, Uniformity and Stability
DUSTNT	*[explanation to be provided from TGP/8 "Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability"]* Details on how to obtain a copy of DUSTNT are provided on the UPOV website at *(to be provided)*
Ear-row	A row of plants grown from seeds obtained from a single ear of a plant.
Editorial Committee	see "Enlarged Editorial Committee (TC-EDC)"
Enlarged Editorial Committee	Enlarged Editorial Committee of the Technical Committee (TC-EDC) (abbreviated to "TC-EDC") (see "[…]" website reference to be provided)
Essential characteristic	Article 6 (1)(d) of the 1961 Convention / 1972 Act and 1978 Acts require that a variety "must be stable in its essential characteristics, that is to say, it must remain true to its description after repeated reproduction or propagation or, where the breeder has defined a particular cycle of reproduction or multiplication, at the end of each cycle." The General Introduction (Chapter 7.2) clarifies that the essential characteristics include at least all characteristics used for the examination of DUS or included in the variety description established at the date of grant of protection of that variety. Therefore, all obvious characteristics may be considered, irrespective of whether they appear in the Test Guidelines or not.
Example variety	example varieties are provided in the Test Guidelines to clarify the states

	of expression of a characteristic (see General Introduction, Chapter 4.3 and TGP/7)
G	Document TGP/9/1, Section 4.3 "Type of record(s)" explains that "For the purposes of distinctness, observations may be recorded as a single record for a group of plants or parts of plants (G), or may be recorded as records for a number of single, individual plants or parts of plants (S).
GAIA	*[explanation to be provided from TGP/8 "Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability"]* Details on how to obtain a copy of GAIA are provided on the UPOV website at *(to be provided)*
General Introduction	abbreviation of document TG/1/3 "General Introduction to the Examination of Distinctness, Uniformity and Stability and the Development of Harmonized Descriptions of New Varieties of Plants"
GN (Test Guidelines)	abbreviation of "Guidance Note" ~~(Test Guidelines)~~
Grouping characteristic	*Grouping characteristics* are those in which the documented states of expression, even where produced at different locations, can be used, either individually or in combination with other such characteristics: (a) to select varieties of common knowledge that can be excluded from the growing trial used for examination of distinctness; and (b) to organize the growing trial so that similar varieties are grouped together. (see General Introduction, Chapter 4.8)
Grouping varieties	see document TGP/9 "Examining Distinctness", Sections 2 and 3 and the definition of "Grouping characteristic"
Growing cycle	Chapter 3.1 of the Test Guidelines makes reference to the number of growing cycles for the DUS test. ~~In some cases it may be necessary to clarify what is meant by a growing cycle. In the case of fruit species, additional standard wording has been developed (see TGP/7 "Development of Test Guidelines": Annex 1: GN 8 and Annex 2: ASW 3).~~
Guidance Note (Test Guidelines)	In addition to the TG Template, further guidance is provided for drafters of Test Guidelines on how to develop individual Test Guidelines from the TG Template. This is provided by means of additional standard wording (ASW) and guidance notes (GN) and indications are provided within the TG Template on where this further guidance is available. (see document TGP/7 "Development of Test Guidelines": Section 3.3).
Independent growing cycle	*explanation to be provided from TGP/8 "Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability"*
Interested Expert (Test Guidelines)	The drafting of Test Guidelines is led by an expert or experts (referred to as the "leading expert(s)") from within one of the UPOV Technical Working Parties (TWPs). The leading expert drafts the Test Guidelines in close cooperation with all those experts of the TWPs who have expressed an interest ("*interested experts*"). (see TGP/7 "Development of Test Guidelines": Section 2.1) *[cross ref.]*
Leading Expert (Test Guidelines)	The drafting of Test Guidelines is led by an expert or experts (referred to as the "*leading expert(s)*") from within one of the UPOV Technical Working Parties (TWPs). The leading expert drafts the Test Guidelines in close cooperation with all those experts of the TWPs who have expressed an interest ("interested experts"). (see TGP/7 "Development of Test Guidelines": Section 2.1) *[cross ref.]*
M, MG, MS	see explanations for "Measurement (M)", "G" and "S"

Measurement (M)	Document TGP/9/1, Section 4.2 “Method of observation (visual or measurement)” explains that “*measurement* (M) is an objective observation against a calibrated, linear scale e.g. using a ruler, weighing scales, colorimeter, dates, counts, etc.”
Member of the Union	member of the International Union for the Protection of New Varieties of Plants: a State party to the 1961 UPOV Convention, the 1972 Act, or the 1978 Act, or a State or intergovernmental organization party to the 1991 Act. (see Article 1(xi) of the 1991 Act)
Note	Each state of expression in the Test Guidelines is allocated a corresponding numerical “Note” for ease of recording of data and for the production and exchange of variety descriptions. (see State of Expression)
Off-type	Where all the plants of a variety are very similar, and in particular for vegetatively propagated and self-pollinated varieties, it is possible to assess uniformity by the number of obviously different plants – “*off-types*” – that occur. In the case of the determination of off-types by visual assessment, a plant is to be considered an off-type if it can be clearly distinguished from the variety in the expression of any characteristic of the whole or part of the plant that is used in the testing of distinctness, taking into consideration the particular features of its propagation. This definition makes it clear that, in the assessment of uniformity, the standard for distinctness between off-types and a candidate variety is the same as for distinctness between a candidate variety and other varieties. (see General Introduction, Chapter 6.4 and document TGP/10 “Examining Uniformity”)
Parent(al) formula	*explanation to be provided from ~~TGP/9 “Examining Distinctness” /~~ TGP/8 “Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability”*
PBR	abbreviation of “plant breeder’s rights”
Plant	In Linnaeus’ system, living things were divided into the Kingdoms Vegetabilia (later Plantae) and Animalia. Fungi and several groups of algae have sometimes been classified as new kingdoms. However, for the purposes of plant breeders’ rights, these are still considered to be plants by many members of the Union.
Plant Breeders’ Right	see “breeder’s right” (abbreviated to “PBR”)
Plant grouping	see “Variety”
Pseudo-qualitative characteristic	In the case of “pseudo-qualitative characteristics,” the range of expression is at least partly continuous, but varies in more than one dimension (e.g. shape: ovate (1), elliptic (2), circular (3), obovate (4)) and cannot be adequately described by just defining two ends of a linear range. In a similar way to qualitative (discontinuous) characteristics – hence the term “pseudo-qualitative” – each individual state of expression needs to be identified to adequately describe the range of the characteristic. (see General Introduction, Chapter 4.4.3)
Qualitative characteristic	“Qualitative characteristics” are those that are expressed in discontinuous states (e.g. sex of plant: dioecious female (1), dioecious male (2), monoecious unisexual (3), monoecious hermaphrodite (4)). These states are self-explanatory and independently meaningful. All states are

	necessary to describe the full range of the characteristic, and every form of expression can be described by a single state. The order of states is not important. As a rule, the characteristics are not influenced by environment. (see General Introduction, Chapter 4.4.1)
Quantitative characteristic	"Quantitative characteristics" are those where the expression covers the full range of variation from one extreme to the other. The expression can be recorded on a one-dimensional, continuous or discrete, linear scale. The range of expression is divided into a number of states for the purpose of description (e.g. length of stem: very short (1), short (3), medium (5), long (7), very long (9)). The division seeks to provide, as far as is practical, an even distribution across the scale. The Test Guidelines do not specify the difference needed for distinctness. The states of expression should, however, be meaningful for DUS assessment. (see General Introduction, Chapter 4.4.2)
Reference variety	*explanation to be provided from TGP/8 "Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability"*
Relevant characteristic	Article 8 of the 1991 Act deems that a variety is uniform if, "subject to the variation that may be expected from the particular features of its propagation, it is sufficiently uniform in its *relevant characteristics*". Similarly, Article 9 of the 1991 Act requires that a variety "shall be deemed to be stable if its *relevant characteristics* remain unchanged after repeated propagation or, in the case of a particular cycle of propagation, at the end of each such cycle." ~~Extract from document TGP/10/1 Draft 10:~~ Document TGP/10/1, Section 1.2 states that "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), hereinafter referred to as the 'General Introduction', Chapter 6.2, clarifies that 'Relevant characteristics of a variety include at least all characteristics used for the examination of DUS or included in the variety description established at the date of grant of protection of that variety. Therefore, any obvious characteristic may be considered relevant, irrespective of whether it appears in the Test Guidelines or not.' Hence, it is a matter for the authority to decide, in addition to those characteristics included in the UPOV Test Guidelines or national guidelines, which other characteristics it may include in its consideration of distinctness, which must also be considered for uniformity and stability."
S	Document TGP/9/1, Section 4.3 "Type of record(s)" explains that "For the purposes of distinctness, observations may be recorded as a single record for a group of plants or parts of plants (G), or may be recorded as records for a number of single, individual plants or parts of plants (S).
Spaced plant plot/trial	A spaced plant plot/trial is one in which the plants or seeds are planted at defined intervals. Compare to "Drilled plot".
Special characteristic	*Special characteristics* are those which are: characteristics based on the response to external factors, such as living organisms (e.g. disease resistance characteristics) or chemicals (e.g. herbicide resistance characteristics) (see General Introduction, Chapter 4.6.1); characteristics based on chemical constituents (see General Introduction, Chapter 4.6.2); and combined characteristics (see General Introduction, Chapter 4.6.3 and "combined characteristics" in this document) (see TGP/12 "Special Characteristics")

Stability	Article 9 "*Stability*" of the 1991 Act states: "The variety shall be deemed to be stable if its relevant characteristics remain unchanged after repeated propagation or, in the case of a particular cycle of propagation, at the end of each such cycle."
Standard Test Guidelines characteristic	Standard Test Guidelines characteristics are those which are approved by UPOV for examination of DUS and from which members of the Union can select those suitable for their particular circumstances. (see General Introduction, Chapter 4.8)
State of Expression	States of expression (e.g. short/medium/tall; white/yellow/red; early/medium/late) are given for each characteristic in the Test Guidelines to define the characteristic and to harmonize descriptions. Each state of expression is allocated a corresponding numerical "note" for ease of recording of data and for the production and exchange of the description. (see "Note")
Subgroup (Test Guidelines)	see "Test Guidelines Subgroup"
TC	abbreviation of "*UPOV Technical Committee" (see "[…]" website reference to be provided)*
TC-EDC	abbreviation of "Enlarged Editorial Committee"
Technical Committee	*UPOV Technical Committee (abbreviated to "TC") (see "[…]" website reference to be provided)*
Technical Questionnaire	To help in the process of examining varieties, certain information is requested from the breeder, usually through a Technical Questionnaire to be submitted with the application. The model Technical Questionnaire, included in the Test Guidelines, seeks information on specific characteristics of importance for distinguishing varieties, information on the breeding scheme of the variety and any other information which may help to distinguish the variety. It also requests the breeder to identify similar varieties and characteristics by which the candidate may be distinguished from these similar varieties. (Abbreviated to "TQ") (General Introduction, Chapter 5.3.1.4)
Technical Working Party	*UPOV Technical Working Party (abbreviated to "TWP") (see "[…]" website reference to be provided)*
Technical Working Party for Agricultural Crops	*UPOV Technical Working Party for Agricultural Crops (abbreviated to "TWA") (see "[…]" website reference to be provided)*
Technical Working Party for Fruit Crops	*UPOV Technical Working Party for Fruit Crops (abbreviated to "TWF") (see "[…]" website reference to be provided)*
Technical Working Party for Ornamental Plants and Forest Trees	*UPOV Technical Working Party for Ornamental Plants and Forest Trees (abbreviated to "TWO") (see "[…]" website reference to be provided)*
Technical Working Party for Vegetables	*UPOV Technical Working Party for Vegetables (abbreviated to "TWV") (see "[…]" website reference to be provided)*
Technical Working Party	*UPOV Technical Working Party on Automation and Computer Programs (abbreviated to "TWC") (see "[…]" website reference to be provided)*

on Automation and Computer Programs	
Territory	"*territory*", in relation to a UPOV member, means, where the UPOV member is a State, the territory of that State and, where the UPOV member is an intergovernmental organization, the territory in which the constituting treaty of that intergovernmental organization applies. (see Article 1(viii) of the 1991 Act)
Test Guidelines	abbreviation of UPOV "Guidelines for the Conduct of Tests for Distinctness, Uniformity and Stability". The purpose of the *Test Guidelines* is to elaborate the principles contained in the General Introduction (document TG/1/3), and its associated TGP documents, into detailed practical guidance for the harmonized examination of distinctness, uniformity and stability (DUS) and, in particular, to identify appropriate characteristics for the examination of DUS and production of harmonized variety descriptions. (see General Introduction)
Test Guidelines characteristic	see also "*Standard Test Guidelines characteristic*", "*Grouping characteristic*" and "*Asterisked characteristic*" (see General Introduction, Chapter 4.8)
Test Guidelines Subgroup	The Technical Working Party (TWP) establishes a subgroup consisting of the leading expert and the other interested experts wishing to participate in the drafting of the Test Guidelines in question. (see TGP/7 "Development of Test Guidelines": Section 2.4)
TG	Test Guidelines
TG Drafter's Kit	see Drafter's kit for Test Guidelines
TG Template	UPOV has developed a template ("*TG Template*") containing the universal standard wording which is appropriate for all UPOV Test Guidelines and which is prepared in the appropriate format. The TG Template is presented in document TGP/7 "Development of Test Guidelines", Annex 1.
TGP documents	series of documents associated to the General Introduction specifying Test Guidelines' Procedures (see General Introduction, Chapter 1 and Annex)
TQ	abbreviation of "Technical Questionnaire"
TWA	abbreviation of "*UPOV Technical Working Party for Agricultural Crops" (see "[…]" website reference to be provided)*
TWC	abbreviation of "*UPOV Technical Working Party on Automation and Computer Programs" (see "[…]" website reference to be provided)*
TWF	abbreviation of "*UPOV Technical Working Party for Fruit Crops" (see "[…]" website reference to be provided)*
TWO	abbreviation of "*UPOV Technical Working Party for Ornamental Plants and Forest Trees" (see "[…]" website reference to be provided)*
TWP	abbreviation of "*UPOV Technical Working Party" (see "[…]" website reference to be provided)*
TWV	abbreviation of "*UPOV Technical Working Party for Vegetables" (see "[…]" website reference to be provided)*
Uniformity	Article 8 "*Uniformity*" of the 1991 Act states: "The variety shall be deemed to be uniform if, subject to the variation that may be expected from the particular features of its propagation, it is sufficiently uniform in its relevant characteristics."
UPOV	International Union for the Protection of New Varieties of Plants
UPOV code	see UPOV Code System

UPOV Code System	The main purpose of the UPOV Code System is to enhance the usefulness of the UPOV-ROM Plant Variety Database (“UPOV-ROM”) by overcoming the problem of synonyms for plant taxa. That is achieved by attributing each taxa a code according to the UPOV Code System (“UPOV code”); synonyms for the same plant taxa are attributed the same UPOV code. An explanation of the UPOV Code System is provided at *(“[…]” website reference to be provided)*
UPOV member	see “*member of the Union*”
UPOV-ROM	UPOV-ROM Plant Variety Database
V, VG, VS	see explanations for “Visual observation (V)”, “G” and “S”
Variety	Article 1(vi) of the 1991 Act states that: “(vi)“variety” means a plant grouping within a single botanical taxon of the lowest known rank, which grouping, irrespective of whether the conditions for the grant of a breeder’s right are fully met, can be - defined by the expression of the characteristics resulting from a given genotype or combination of genotypes, - distinguished from any other plant grouping by the expression of at least one of the said characteristics and - considered as a unit with regard to its suitability for being propagated unchanged;”
Variety collection	~~a collection of varieties of common knowledge which are relevant for the examination of distinctness of candidate varieties~~ ~~(see document TGP/4 “Constitution and [Management] / [Maintenance] of Variety Collections”)~~ Document TGP/4/1, Section 1.3 explains that a *variety collection* is a collection of varieties of common knowledge* which are relevant for the examination of distinctness of candidate varieties according to document TGP/4/1, Section 2 “Constitution of Variety Collections”. (**variety of common knowledge* is an abbreviation of “variety whose existence is a matter of common knowledge at the time of the filing of the application” (see “Distinctness”)
Variety denomination	The UPOV Convention requires that a variety shall be designated by a denomination which will be its generic designation. (see Article 20 (1) of the 1991 Act / Article 13 (1) of the 1978 Act)
Variety of common knowledge	an abbreviation of “variety whose existence is a matter of common knowledge at the time of the filing of the application”. (see “Distinctness”)
Visual observation (V)	Document TGP/9/1, Section 4.2 “Method of observation (visual or measurement)” explains that “*visual observation* (V) is an observation made on the basis of the expert’s judgement. For the purposes of this document, “visual” observation refers to the sensory observations of the experts and, therefore, also includes smell, taste and touch. Visual observation includes observations where the expert uses reference points (e.g. diagrams, example varieties, side-by-side comparison) or non-linear charts (e.g. color charts).”

Working Group on Biochemical and Molecular Techniques, and DNA-Profiling in Particular	*UPOV Working Group on Biochemical and Molecular Techniques, and DNA-Profiling in Particular (BMT) (abbreviated to "BMT") (see "[…]" website reference to be provided)*

Terms to be ***excluded*** *from TGP/14*

Non-UPOV specific terms: for example, "vegetatively propagated", "cross-pollinated", "self-pollinated", "seed-propagated", "hybrid", etc.
Terms in the UPOV Convention which are not explained in the General Introduction or other TGP documents: for example, "features of propagation"

SECTION 2. BOTANICAL TERMS

SUBSECTION 1. INTRODUCTION

The purpose of this document (TGP/14 Section 2: Botanical Terms) is:

(a) to provide guidance on the development of characteristics related to plant shapes, plant structures and color;

(b) to provide standard illustrations of plant shapes, plant structures and color patterns which may be useful for inclusion in Test Guidelines, whilst noting that illustrations for specific characteristics can be found in the relevant Test Guidelines and noting that searches for relevant individual characteristics can be made through TGP/7 "Collection of Approved Characteristics"; and

(c) to provide definitions of botanical terms (e.g. dentate, fastigiate, exserted, elliptic, acute, etc.) which form states of expression for characteristics used in the examination of DUS. Emphasis is placed on the states of expression because those are the basis for the assessment of DUS and, therefore, need to be understood specifically in relation to that function. This document provides illustrations and definitions of some terms which, although not used in the Test Guidelines, may be useful for breeders / applicants for characteristics formulated for use in the Technical Questionnaire. The definitions in this document provide an indication of whether terms are generally used in Test Guidelines, or whether alternative terms might be more appropriate for use in Test Guidelines. In general, the meaning of botanical terms which are used in the Test Guidelines to indicate the relevant part of the plant to be examined, but which are not themselves used as states of expression (e.g. bract, petal, berry, etc.), do not require a UPOV-specific definition and are not included in this document.

SUBSECTION 2. SHAPES AND STRUCTURES

I. SHAPE

1. Components of Shape

1.1 Document TG/1/3 "General Introduction to the Examination of Distinctness, Uniformity and Stability and the Development of Harmonized Descriptions of New Varieties of Plants" (General Introduction) explains that shape can be considered in terms of a pseudo-qualitative characteristic:

> "4.4.3 <u>Pseudo-Qualitative Characteristics</u>
>
> "In the case of 'pseudo-qualitative characteristics', the range of expression is at least partly continuous, but varies in more than one dimension (e.g. shape: ovate (1), elliptic (2), circular (3), obovate (4)) and cannot be adequately described by just defining two ends of a linear range. In a similar way to qualitative (discontinuous) characteristics – hence the term 'pseudo-qualitative' – each individual state of expression needs to be identified to adequately describe the range of the characteristic."

However, document TGP/9 "Examining Distinctness" explains that the use of pseudo-qualitative characteristics for the assessment of distinctness on the basis of notes has particular limitations (see document TGP/9/1 Draft 6, Section 5.2.3) *[cross ref.]* :

> *"Pseudo-qualitative (PQ) characteristics*
>
> "[…]
>
> "5.2.3.6 […] However, an important additional factor with pseudo-qualitative characteristics is that, whilst a part of the range is continuous, there is not an even distribution across the scale and the range varies in more than one dimension (e.g. shape: ovate (1), elliptic (2), circular (3), obovate (4): there is a variation in the length/width ratio and in the position of the widest point[1]). This means that it is difficult to define a general rule on the difference in Notes to establish distinctness within a characteristic."

1.2 Therefore, for the purposes of DUS examination, it can be useful to develop quantitative or qualitative characteristics related to shape, rather than considering shape as a single pseudo-qualitative characteristic. In that respect, it is possible to define a plane shape using the following components:

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[1] The term "broadest part" is used in preference to "widest point" in this document, because the broadest part may be a point (e.g. for a circle) or, in cases where the sides are parallel (e.g. for an oblong), the broadest part is situated along a length (see Section 1.2(b)).

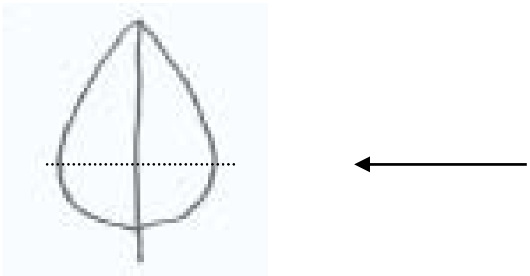
(a) Ratio length/width (or ratio width/length)

(used as a generic term in this document to cover also ratio: thickness/length; diameter/length; thickness/width, for cross-sections of 3 dimensional shapes)

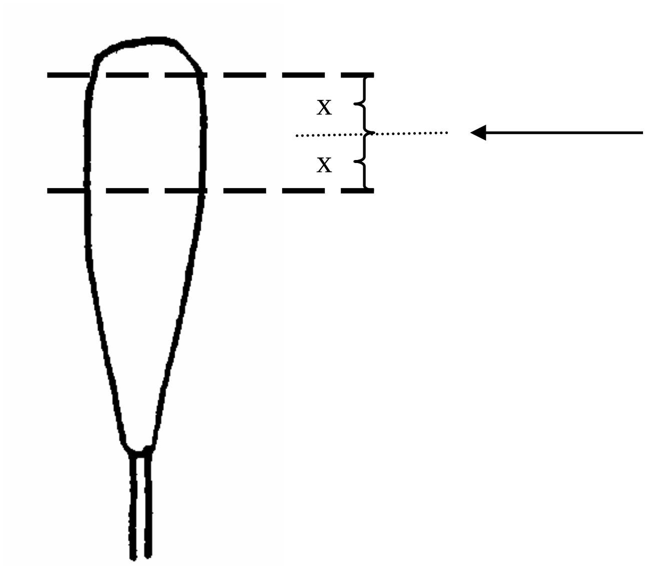
[b] ~~To ensure that the ratio length/width is clearly understood, it is recommended to use meaningful states such as "very elongated", rather than states such as "very high". To avoid confusion concerning the absolute dimensions, it is recommended to avoid the use of terms such as "narrow" and "broad" for ratio length/width, particularly where characteristics for the absolute dimensions are also included for the same plant part~~;

(b) Position of broadest part

The broadest part may be a point (e.g. for a circle) or, in cases where the sides are parallel (e.g. for an oblong), the broadest part is situated along a length. In cases where the broadest part is not a precise point, the position of the broadest part is considered to be the mid-point along the broadest part. For example:



position of broadest part



position of broadest part (mid-point of length of broadest part)

(c) Shape of base (see Section 2.3 Base *[cross ref.]*);

(d) Shape of apex (see Section 2.4 Apex *[cross ref.]*);

(e) Lateral outline.

[c]1.3 The apex (apical or distal part) of an organ or plant part is the end furthest from the point of attachment. The base (proximal part) of a plant part is the end nearest to the point of attachment. However, it should be noted that the illustrations of shapes in the Test Guidelines might not always be orientated with the point of attachment (base) at the bottom if that is not the natural orientation of the organ on the plant.

1.~~3~~4 The shape of base and shape of apex are considered in Sections 2.3 and 2.4 *[cross ref.]* respectively. The chart below (Chart for Simple Symmetric Plane Shapes) illustrates the other three components for simple symmetric plane shapes (those for which the angle at the base and at the apex does not exceed 180°) as follows:

(a) Ratio length/width (or ratio width/length): the ratio length/width varies from left to right within a row [but is approximately the same within a column];

(b) Position of broadest part: the position of the broadest part varies from row to row [but is approximately the same in each row];

(c) Lateral outline: the shape of the lateral sides varies from set to set [but is approximately the same within a set].

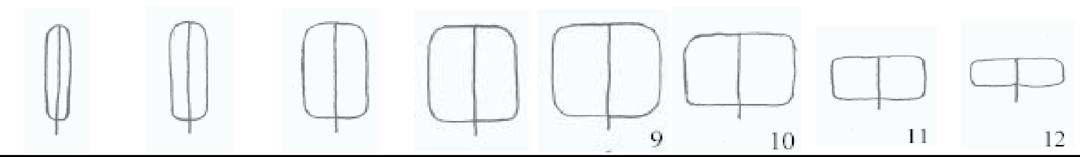
1.~~4~~5 To ensure that the ratio length/width is clearly understood, it is recommended to use meaningful states such as "very elongated", rather than states such as "very high". To avoid confusion concerning the absolute dimensions, it is recommended to avoid the use of terms such as "narrow" and "broad" for ratio length/width, particularly where characteristics for the absolute dimensions are also included for the same plant part. The terms associated with certain length/width ratios used in the Chart for Simple Symmetric Plane Shapes are only intended to illustrate the use of ratio length/width. In the Test Guidelines, the use of terms such as "[very/moderately/slightly] elongated" and "[very/moderately/slightly] compressed" will need to be determined according to the range of expression for the characteristic concerned. ~~Those terms are not necessarily appropriate for use in the Test Guidelines, because terms such as "narrow" and "broad" may be used in relation to the range of expression for the characteristic concerned. For example, if the range for the ratio length/width within a characteristic is from 2:1 to 1:1, then the ratio 2:1 may be indicated as "narrow" (not "medium" as indicated in the Chart for Simple Symmetric Plane Shapes) and the ratio 1:1 as "broad" (not "very broad" as indicated in the Chart for Simple Symmetric Plane Shapes).~~ [d]

Chart for Simple Symmetric Plane Shapes

ratio length/width	[d] ~~>6:1~~	~~6:1 to 3:1~~ very elongated	~~2:1 to 1.5:1~~ moderately elongated	~~1.2:1~~ slightly elongated	~~1:1~~ medium	~~1:1.2~~ slightly compressed	~~1:1.5 to 1:2~~ moderately compressed	~~1:3 to 1:6~~ very compressed

Parallel set

oblong

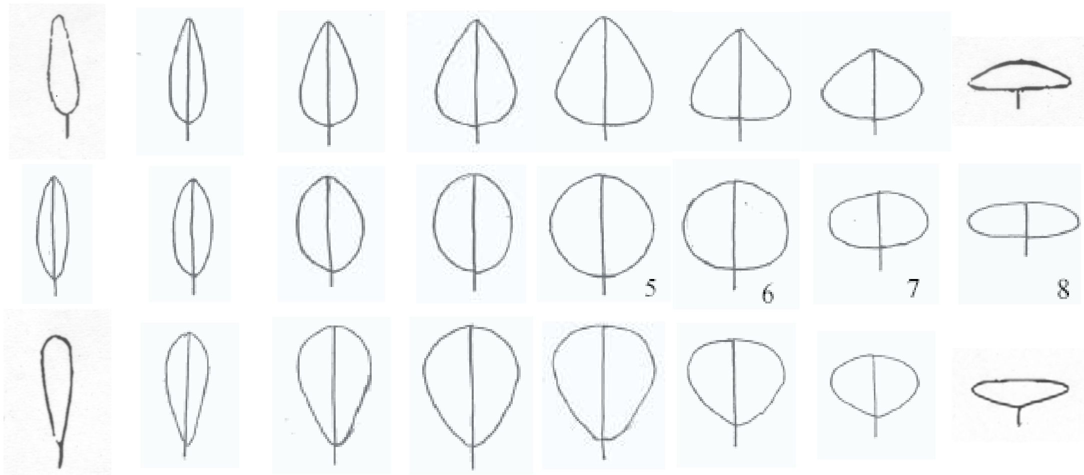


Rounded set

ovate

elliptic

obovate



Angular set

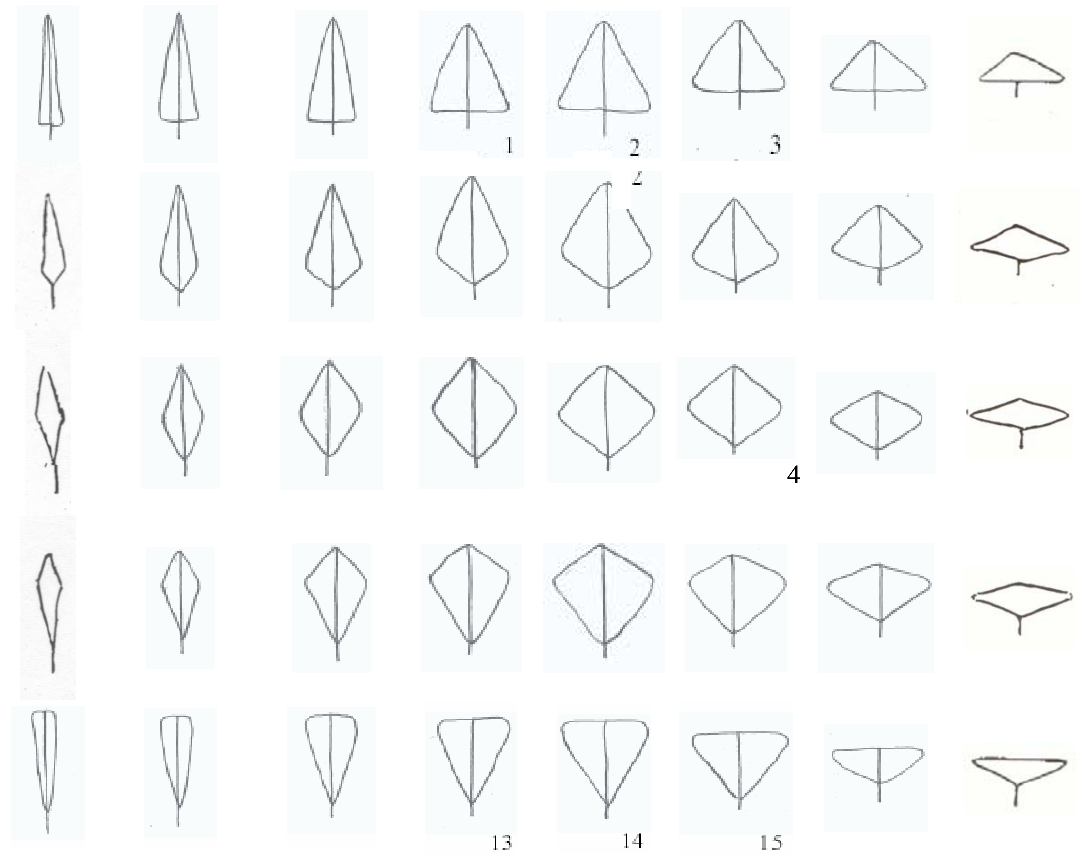
triangular

trullate

rhombic

obtrullate

obtriangular



1	(narrow deltate)	9	square
2	(medium deltate)	10	transverse broad oblong
3	(broad deltate)	11	transverse medium oblong
4	(quadrate rhombic)	12	transverse narrow oblong
5	circular	13	(narrow obdeltate)
6	narrow oblate	14	(medium obdeltate)
7	medium oblate	15	(broad obdeltate)
8	broad oblate		

Notes

Parallel set: the lateral sides are more or less straight over most of their length and more or less parallel to the main axis (The leaves of most of the monocotyledons belong in this group.)

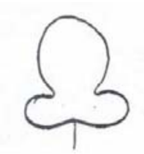
Rounded set: the lateral sides are rounded in a single, sweeping curve, without sudden changes of direction (The leaves of most of the dicotyledons belong in this group.)

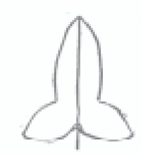
Angular set: the lateral sides are somewhat bent at a certain point, resulting in a change of direction, combined with a somewhat straightening towards the base and apex from that point and more or less forming two triangles joined at the longitudinal axis.

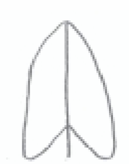
1.5 The following chart (Chart for Other Plane Shapes) illustrates some other common plane shapes:

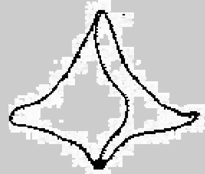
Chart for Other Plane Shapes

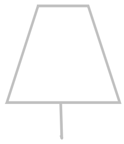
For each of the shapes below, ranges for ratio length/width (or ratio width/length) and position of broadest part can be developed, in a similar way to that shown in the Chart for Simple Symmetric Plane Shapes (Section 1.3 *[cross ref.]*).


auriculiform

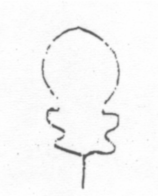

hastiform

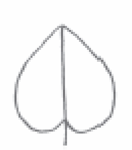

sagittate

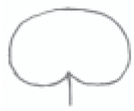

alate [e]

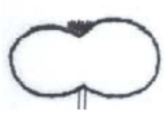

trapezoidal

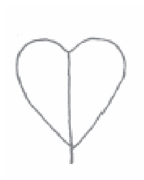

~~semi-elliptic~~ flabellate (fan shape) [f]

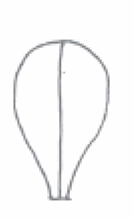

lyrate

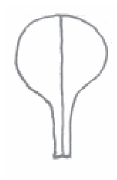

cordiform


reniform


~~transverse 8 shape~~ lemniscate [g]

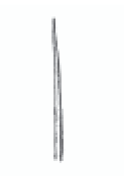

obcordiform

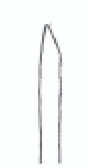

spatulate


clawed

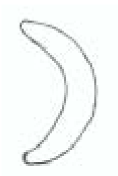

clavate [h]


stellate


acicular


subulate


falcate


lunate

The TWV agreed that it would be useful to consider developing a decision-tree, similar to that developed by Japan for color patterns in document TWV/42/3 Add.; Annex, for determining appropriate shape terms.

2. Developing Shape-Related Characteristics

2.1 Introduction

2.1.1 In general, it can be most useful to consider the variation in shape between varieties in the variety collection using the following steps:

Step 1: Ratio length/width (or ratio width/length) (see Section 1 *[cross ref.]*);

Step 2: Position of broadest part (see Section 1 *[cross ref.]*);

Step 3: Shape of base (see Section 2.3 Base *[cross ref.]*);

Step 4: Shape of apex (see Section 2.4 Apex *[cross ref.]*);

Step 5: Lateral outline (see Section 1 *[cross ref.]*).

Thus, if all the variation in shape between varieties in the variety collection is accounted for by the ratio length/width (e.g. narrow elliptic, medium elliptic or broad elliptic), it is only necessary to have a characteristic "ratio length/width" (or ratio width/length). Similarly, if all the variation in shape between varieties in the variety collection is accounted for by ratio length/width and position of broadest part (e.g. all varieties fall within the rounded set in the Chart for Simple Symmetric Plane Shapes) it is only necessary to have the characteristics "ratio length/width" (or ratio width/length) and "position of broadest part". It is only necessary to go to subsequent steps when the variation in shape between varieties in the variety collection has not been accounted for by the preceding steps/components. Duplication of the same difference in two separate characteristics should be avoided: for example, the use of characteristics for both ratio length/width and for shape should be avoided where states of expression of the characteristic for shape relate to different length/width ratios.[i]

2.1.2 In general, where shape characteristics are developed on the basis of the individual components above, it is appropriate to present the characteristics in the order of the steps 1 to 5. However, a particular exception to this approach should be made where a qualitative characteristic is identified. Qualitative characteristics should be presented as the first of the series of shape-related characteristics because of the value of such characteristics for assessing distinctness and because the examination of subsequent shape-related characteristics may not be relevant for varieties with certain states of expression for the qualitative characteristic. For example, "Only varieties with Leaf lateral outline: ovate: Leaf: ratio length/width (or ratio width/length)" might be appropriate if the preceding characteristic for "Leaf: lateral outline" was qualitative, e.g. ovate (1); hastiform (2)) and there was no useful variation in ratio length/width for hastiform varieties.

2.1.3 Notwithstanding the difficulty in using a difference in Notes to establish distinctness for a pseudo-qualitative characteristic (see Section 1 *[cross ref.]*)), it may be appropriate to develop a single pseudo-qualitative characteristic for shape. In such cases, it is important that the difference between the states of expression is indicated in an illustration. The illustration should, as far as possible, place the states with the least difference closest together, regardless of their notes, e.g. the illustrations for notes 1 and 5 might be positioned side-by-side and notes 2 and 4 might be further apart. Where the overall shape is presented as a single pseudo-qualitative characteristic, the order of states should be: primary order, broadest part below middle to broadest part above middle; secondary order, narrow to broad (high to low ratio length/width) (see Section 2.2, Example 5, Alternative 2)[j].

2.2 Full plane shape characteristics

The following illustrations provide examples of variation in full plane shape components (ratio length/width, position of broadest part and lateral outline) for the development of characteristics, either as characteristics for the individual components or as a single overall shape characteristic:

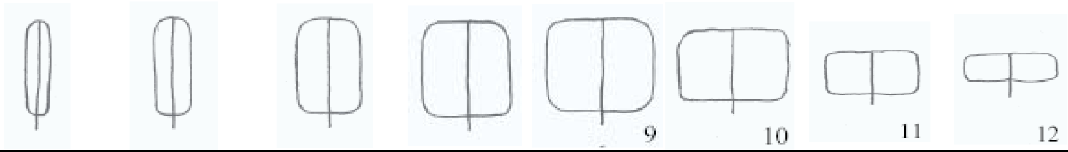
The TWA proposed to amend the examples to avoid an implication that particular shapes would have particular notes (e.g. ovate (1); elliptic (2); obovate (3)). *Office of the Union comment: possibly no change necessary because in Example 2 "ovate" has note 1; in Example 3 "narrow ovate" has note 2; in example 4 "ovate" has note 4, etc.*

Example 1 (a circle indicates the shape of one or more varieties in the variety collection)

The only variation between varieties is found in the ratio length/width.

Parallel set

oblong

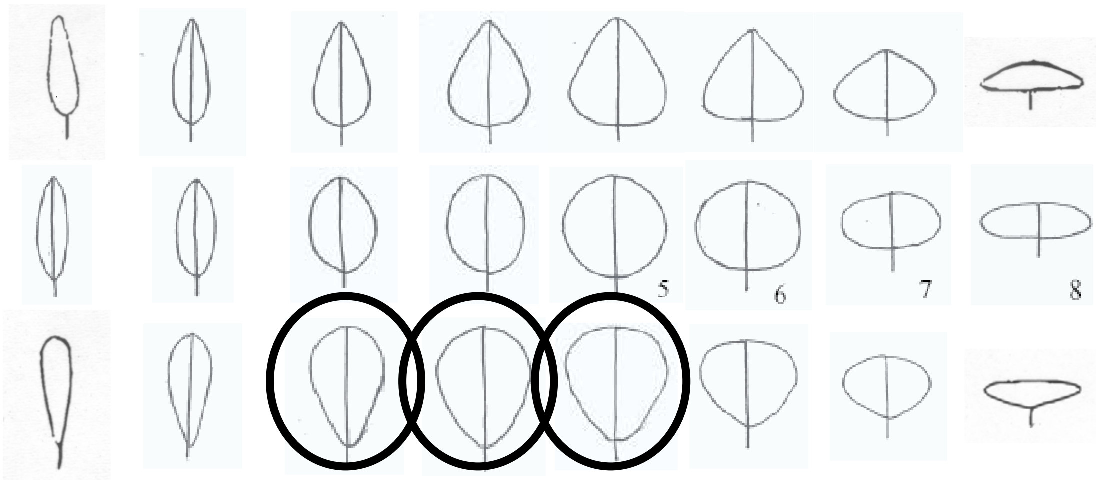


Rounded set

ovate

elliptic

obovate



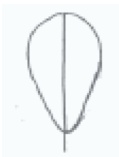
Possible characteristic(s) (Example 1)

Alternative 1

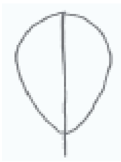
Plant [part]: ratio length/width (elongated to compressed) (QN)

Alternative 2

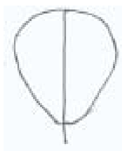
Plant [part]: shape (narrow obovate (1); medium obovate (2); broad obovate (3)) (QN) with the following illustration



ratio length/width: elongated
1
(narrow obovate)



ratio length/width: medium
2
(medium obovate)



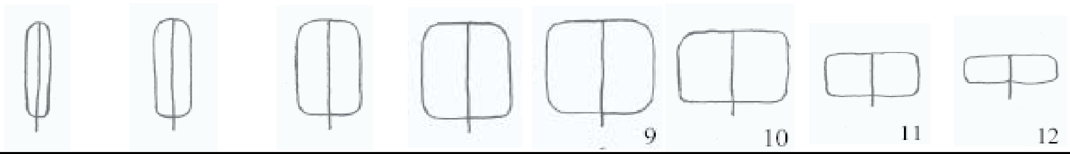
ratio length/width: compressed
3
(broad obovate)

<u>Example 2</u> (a circle indicates the shape of one or more varieties in the variety collection)

The only variation between varieties is found in the position of the broadest part.

Parallel set

oblong

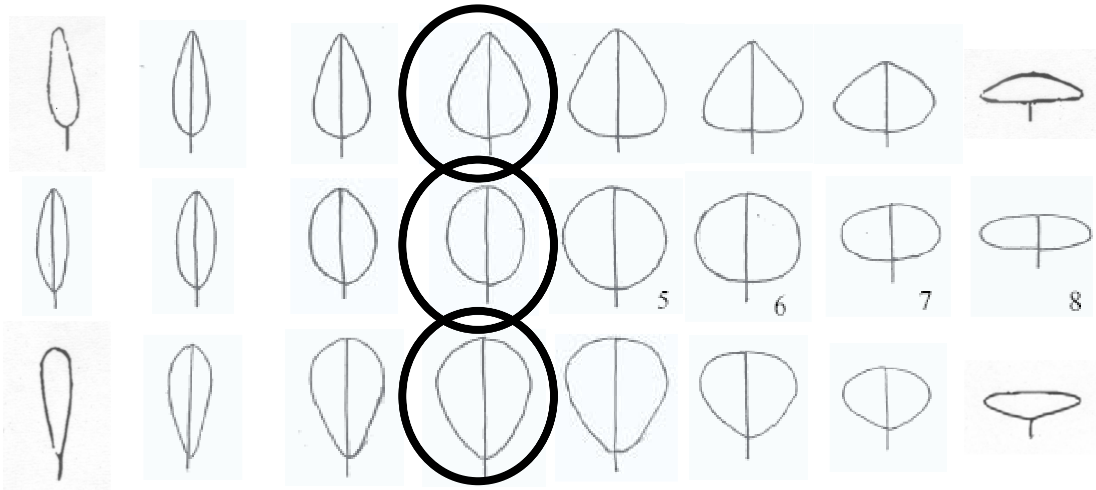


Rounded set

ovate

elliptic

obovate



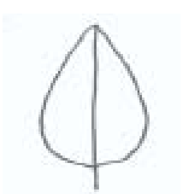
<u>Possible characteristic(s) (Example 2)</u>

<u>Alternative 1</u>

Plant [part]: position of broadest part (towards base to towards apex) (QN)

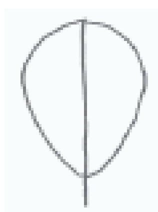
<u>Alternative 2</u>

Plant [part]: shape (ovate (1); elliptic (2); obovate (3)) (QN)
with the following illustration



broadest part towards base
1
ovate

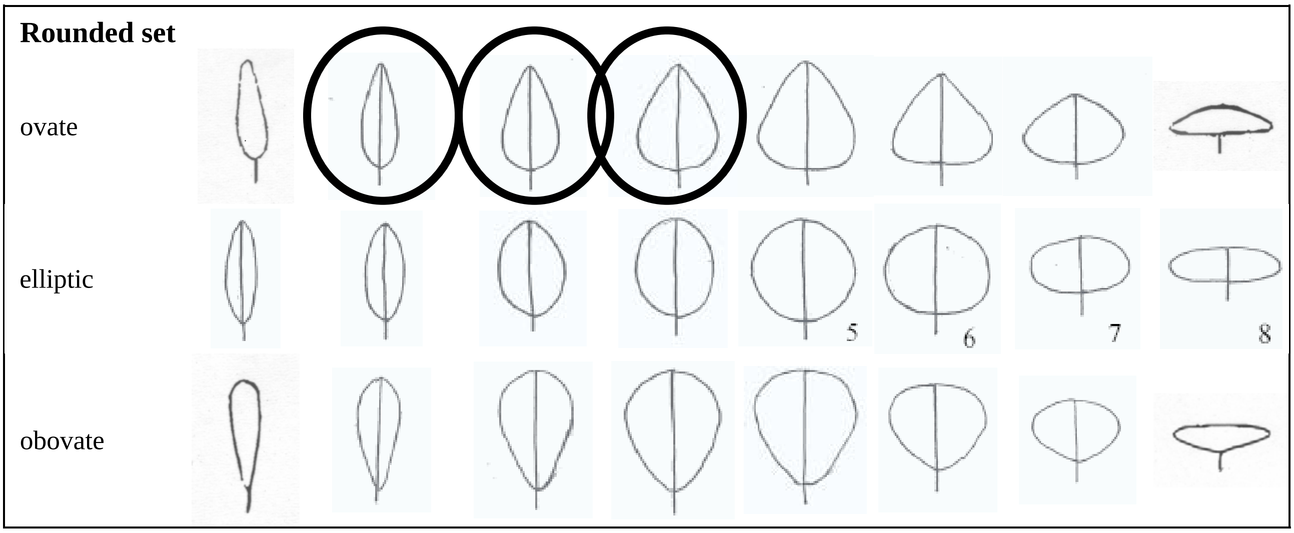
broadest part at middle
2
elliptic

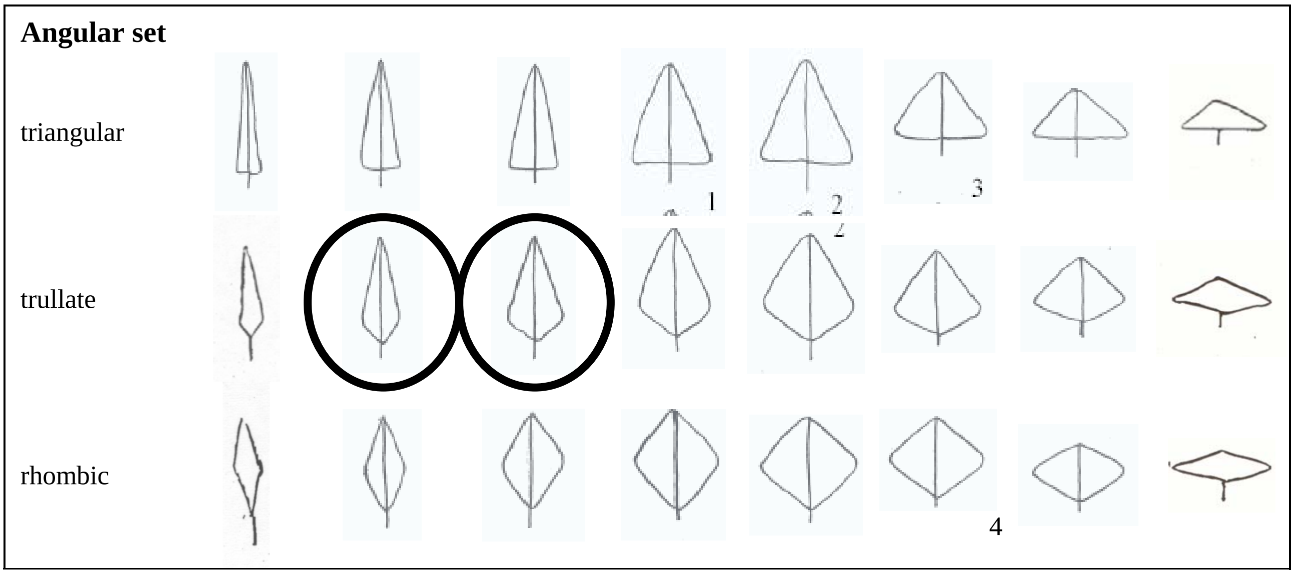


broadest part towards apex
3
obovate

Example 3 (a circle indicates the shape of one or more varieties in the variety collection)

There is variation between varieties in the ratio length/width (or ratio width/length), the shape of the base and the lateral outline. The lateral outline varies between ovate and trullate.





<u>Possible characteristic(s) (Example 3)</u>

<u>Alternative 1</u>

Plant [part]: ratio length/width (elongated to compressed) (QN)

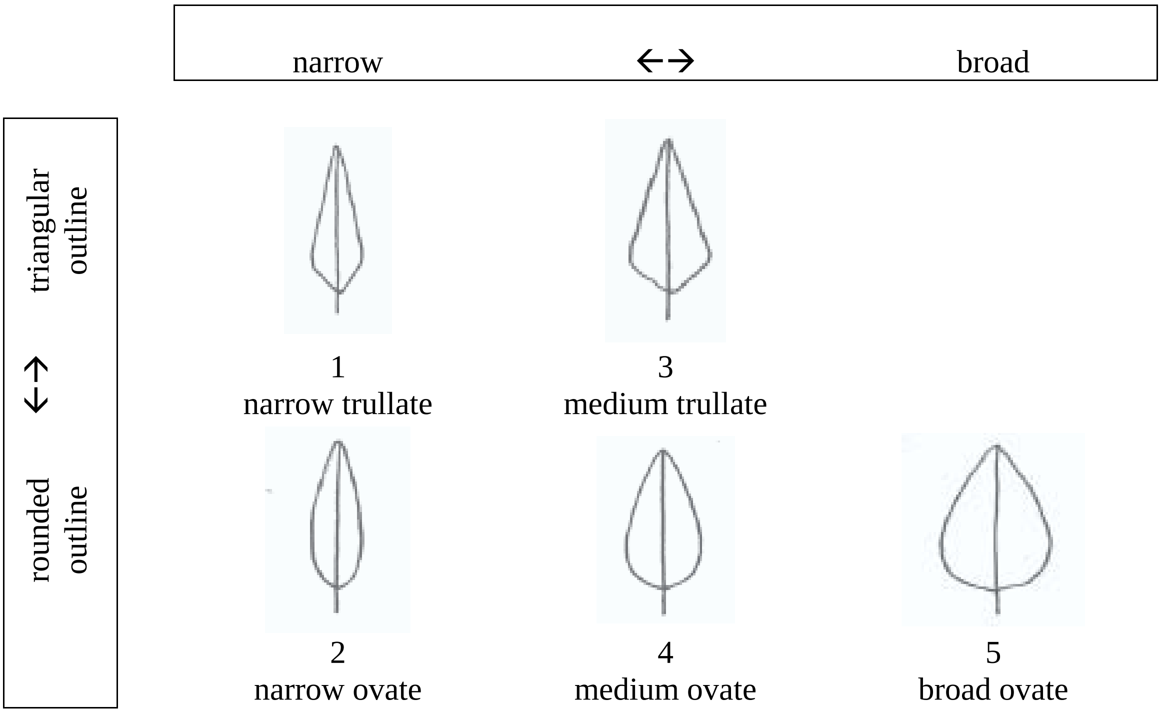
Plant [part]: shape of base (acute, obtuse, rounded) (PQ)

Plant [part]: lateral outline (clearly rounded to clearly triangular) (QN)

<u>Alternative 2</u>

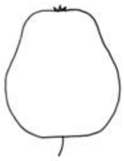
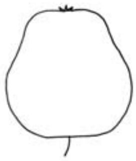
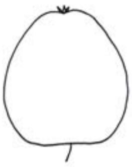
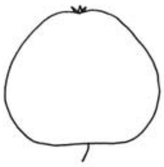
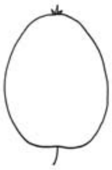
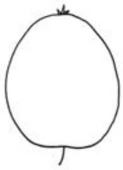
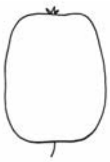
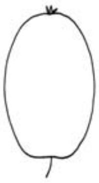
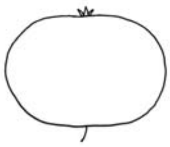
Plant [part]: shape (narrow trullate (1); narrow ovate (2); medium trullate (3); medium ovate (4); broad ovate (5)) (PQ)

with the following illustration



Example 4

There is variation between varieties in the ratio diameter/height, position of broadest part and the lateral outline in the apical half. The lateral outline varies between ovate and trullate.

		ratio diameter/height			
	lateral outline in apical half (Notes)	elongated (3)	medium (5)	compressed (7)	position of broadest part (Notes)
cylindrical waisted	concave (4)				at middle (1); moderately towards base (2); or strongly towards base (3)
conic	flat taper (3)				at middle (1); moderately towards base (2); or strongly towards base (3)
ovoid	rounded (1)				moderately towards base (2); or strongly towards base (3)
cylindrical	parallel (2)				at middle (1)
ellipsoid	rounded (1)	 (elliptic)	 (round)	 (oblate)	at middle (1)

<u>Possible characteristic(s) (Example 4)</u>

<u>Alternative 1</u>

(a) ratio diameter/height (QN):
e.g. very elongated (1); moderately elongated (3); medium (5); moderately compressed (7); very compressed (9);

(b) position of broadest part (QN):
e.g. at middle (1); moderately towards base (2); strongly towards base (3);

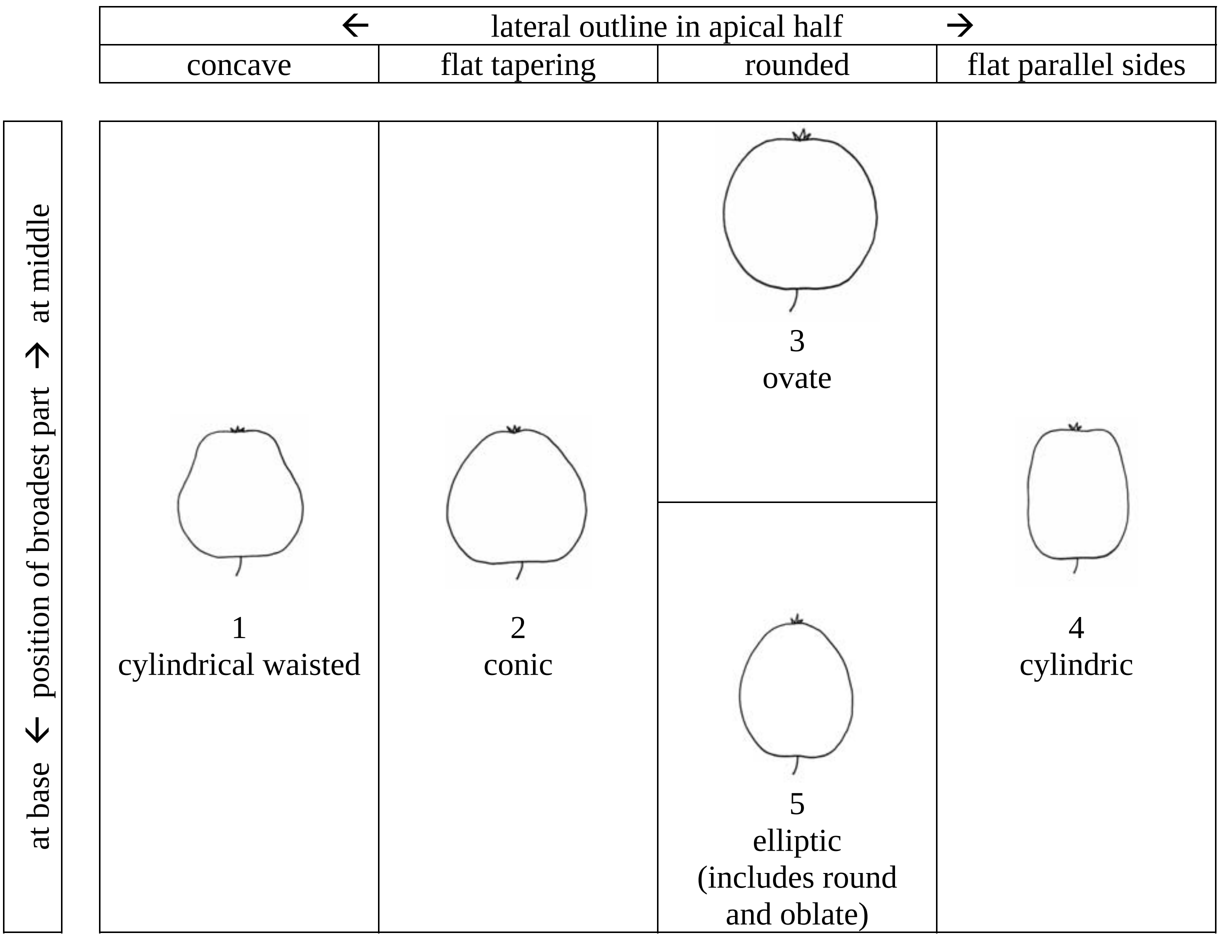
(c) lateral outline in apical half (PQ):
e.g. rounded (1); parallel (2); flat taper (3); concave (4)

<u>Alternative 2</u>

(a) ratio diameter/height (QN):
e.g. very elongated (1); moderately elongated (3); medium (5); moderately compressed (7); very compressed (9)

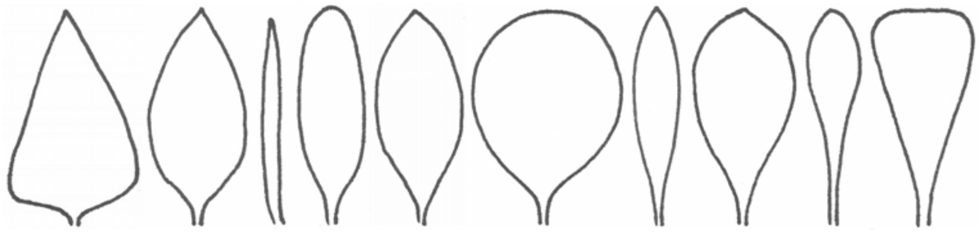
(b) general shape (PQ):
e.g. cylindrical waisted (1); conic (2); ovate (3); cylindric (4); elliptic (5)

with the following illustration:



Example 5

the variation between the range of shapes indicated by the illustrations below:



Possible characteristic(s) (Example 5)

Alternative 1

(a) ratio length/width (QN):
e.g. very elongated (1); moderately elongated (3); medium (5); moderately compressed (7); very compressed (9)

(b) position of broadest part (QN):
e.g. strongly towards base (1); moderately towards base (3); at middle (5); moderately towards apex (7); strongly towards apex (9)

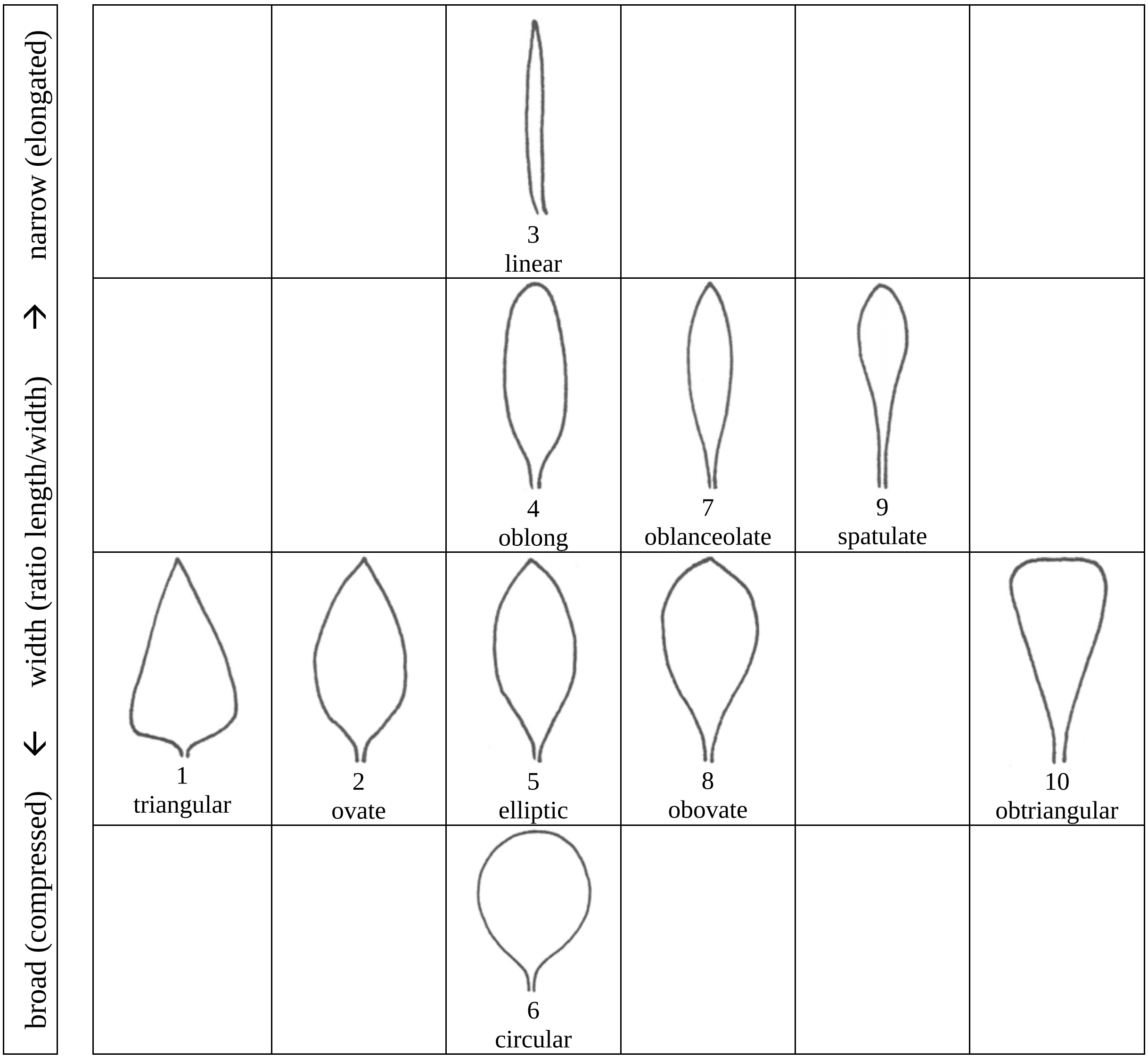
Alternative 2

General shape (PQ): triangular (1); ovate (2); linear (3); oblong (4); elliptic (5); circular (6); oblanceolate (7); obovate (8); spatulate (9); obtriangular (10)

(Note: Where the overall shape is presented as a single pseudo-qualitative characteristic, the order of states should be: primary order, broadest part below middle to broadest part above middle; secondary order, narrow to broad (high to low ratio length/width)).

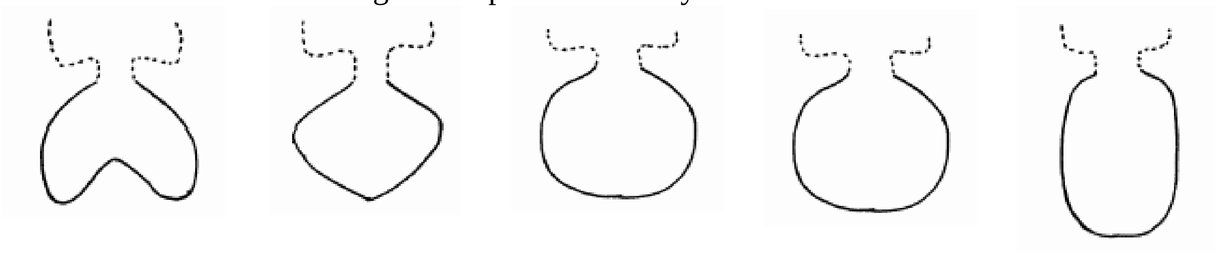
with the following illustration:

← broadest part →		
(below middle)	at middle	(above middle)



Example 6

the variation between the range of shapes indicated by the illustrations below



Possible characteristic(s) (Example 6)

Alternative 1

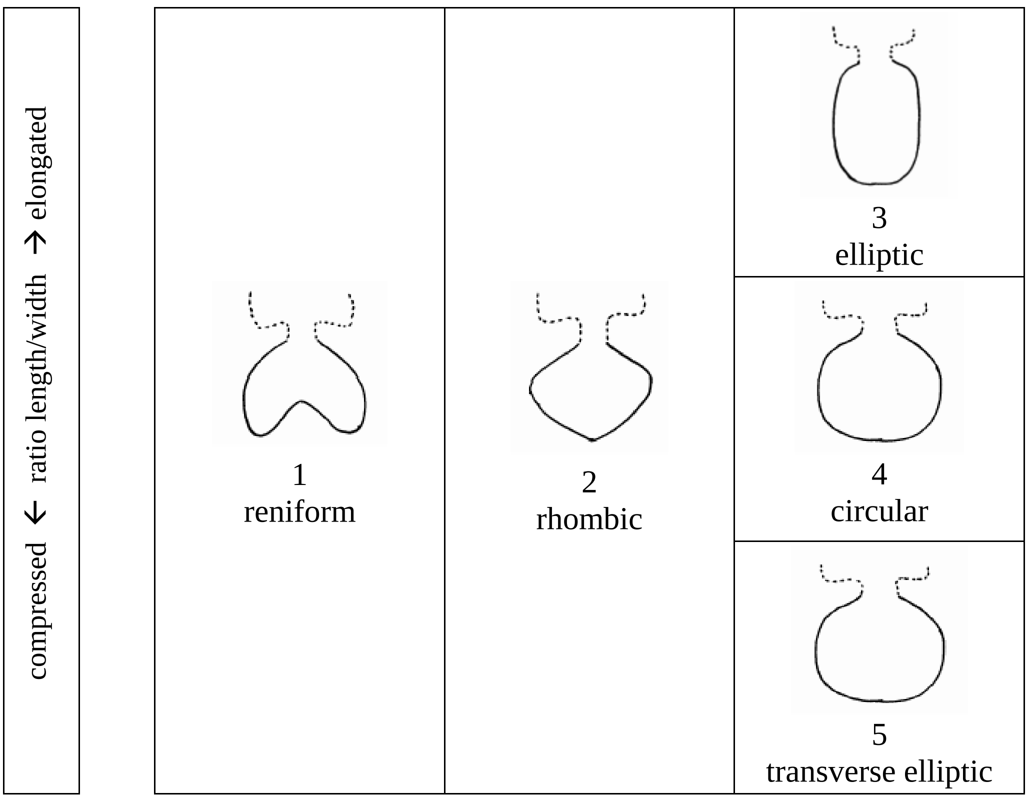
(a) lateral outline (QL)
e.g. reniform (1); rhombic (2); elliptic (3)

(b) ratio length/width (QN):
e.g. elongated (1); medium (2); compressed (3)

Alternative 2

General shape (PQ): reniform (1); rhombic (2); elliptic (3); circular (4);
transverse elliptic (5)

with the following illustration:



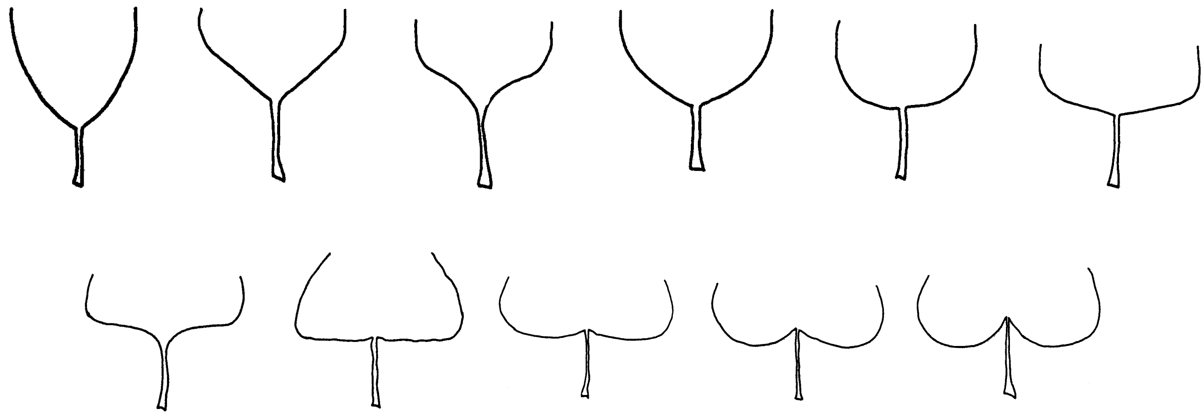
2.3 Base Shape Characteristics

2.3.1 As explained in Section 2.1 *[cross ref.]*, it is only necessary to develop a characteristic for the shape of base when the variation in shape between varieties in the variety collection has not been accounted for by the ratio length/width or the position of the broadest part concerning the full plant part.

2.3.2 In the same way as for plane shapes, whilst a base shape can be considered in terms of a pseudo-qualitative characteristic, it can be useful to develop quantitative or qualitative characteristics related to base shape, rather than considering shape as a single pseudo-qualitative characteristic. A particular example of this is the consideration of the angle of the base (e.g. as a quantitative characteristic) and the curvature at the base, an example of which is provided below for illustrations purposes.

Example

the variation between the range of base shapes indicated by the illustrations below



Possible characteristic(s)

Alternative 1

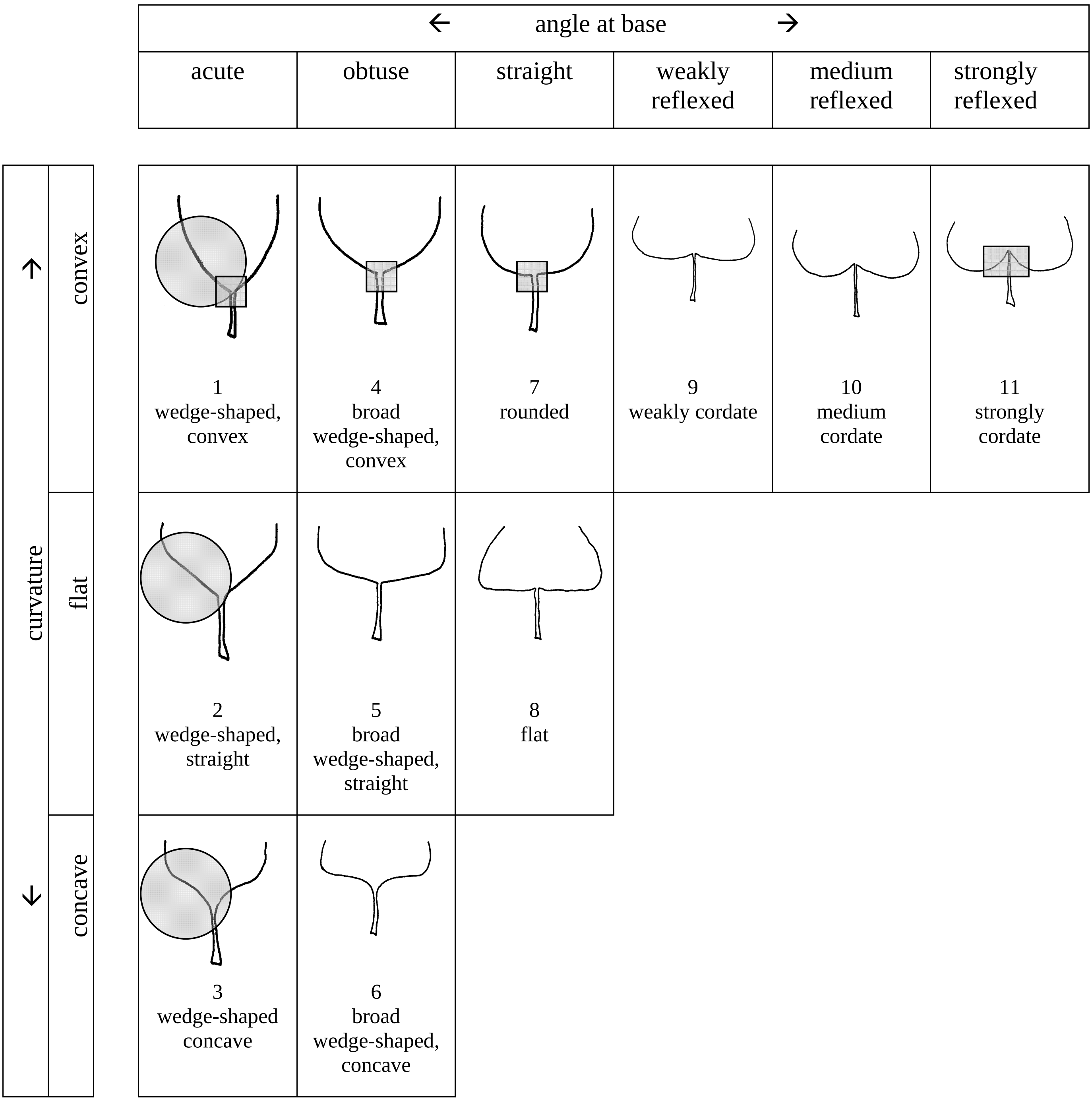
(a) angle of base (QN):
e.g. acute (1); obtuse (2); straight (180°) (3); weakly reflex (4); strongly reflex (5)

(b) curvature at base (QN):
e.g. concave (1); flat (2); convex (3)

Alternative 2

Shape of base (PQ): wedge-shaped, convex (1); wedge-shaped, straight (2); wedge-shaped concave (3); broad wedge-shaped, convex (4); broad wedge-shaped, straight (5); broad wedge-shaped, concave (6); rounded (7); flat (8); weakly cordate (9); medium cordate (10); strongly cordate (11).

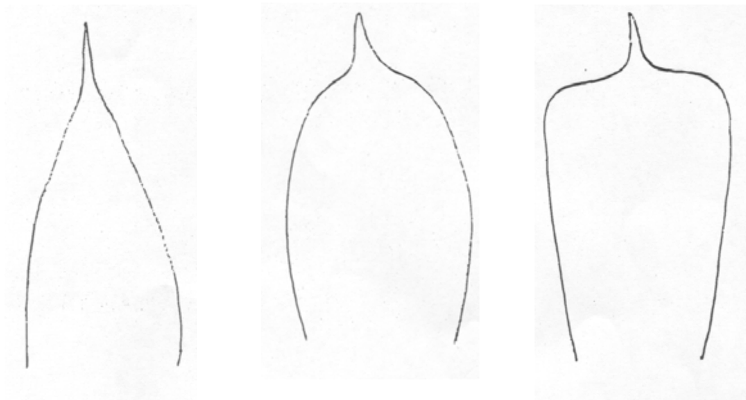
with the following illustration:



2.4 Apex/Tip Shape Characteristics

2.4.1 The APEX (apical or distal part) of an organ or plant part is the end furthest from the point of attachment.

2.4.2 In some cases, the distal extremity of the apex may be differentiated into a "TIP". In such cases, the shape of the apex is taken as the general shape, excluding any differentiated tip (if present). For example:



Differentiated tip:	acuminate	acuminate	acuminate
Apex:	acute	rounded	truncate

2.4.3 As explained in Section 2.1 *[cross ref.]*, it is only necessary to develop a characteristic for the shape of apex when the variation in shape between varieties in the variety collection has not been accounted for by the ratio length/width or the position of the broadest part concerning the full plant part.

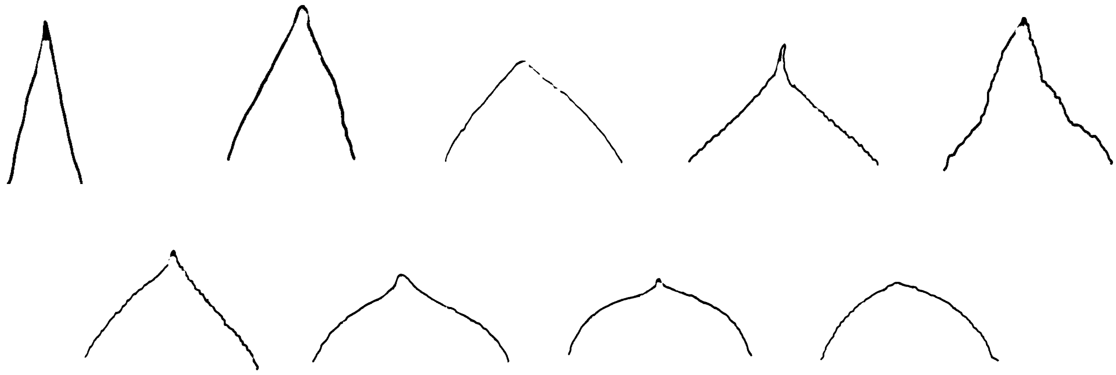
2.4.4 In the same way as for plane shapes, whilst an apex shape can be considered in terms of a pseudo-qualitative characteristic, it can be useful to develop quantitative or qualitative characteristics related to apex shape, rather than considering shape as a single pseudo-qualitative characteristic. A particular example of this is the consideration of the angle of the apex (e.g. as a quantitative characteristic).

2.4.5 In cases where the tip is differentiated within the general shape of the apex, characteristics concerning the shape of the tip may be developed independently from those concerning the general shape of the apex. Different combinations between these two categories are possible, for example: a first characteristic for the general shape of the apex (e.g. acute, obtuse, rounded), together with a second characteristic for emargination at apex (absent, present), or apiculate tip (absent, present).

2.4.6 In the case of tip shapes, it may be more appropriate to have a simple characteristic such as length of tip, rather than using botanical terms. The only difference between mucronate and aristate is the length of the 'tip', the only difference between cuspidate and pungent is the length of the 'tip', and the only difference between emarginate and retuse is the angle [depth?] of the notch. These pairs can therefore also be quantified where applicable, by stating, for example, 'length of tip' or 'depth of notch', instead of using the specific botanical terms.

Example

the variation between the range of apex shapes indicated by the illustrations below



Possible characteristic(s)

Alternative 1

(a) angle of apex (excluding tip, if present) (QN):
e.g. strongly acute (1); moderately acute (2); right-angle (3); moderately obtuse (4); strongly obtuse (5)

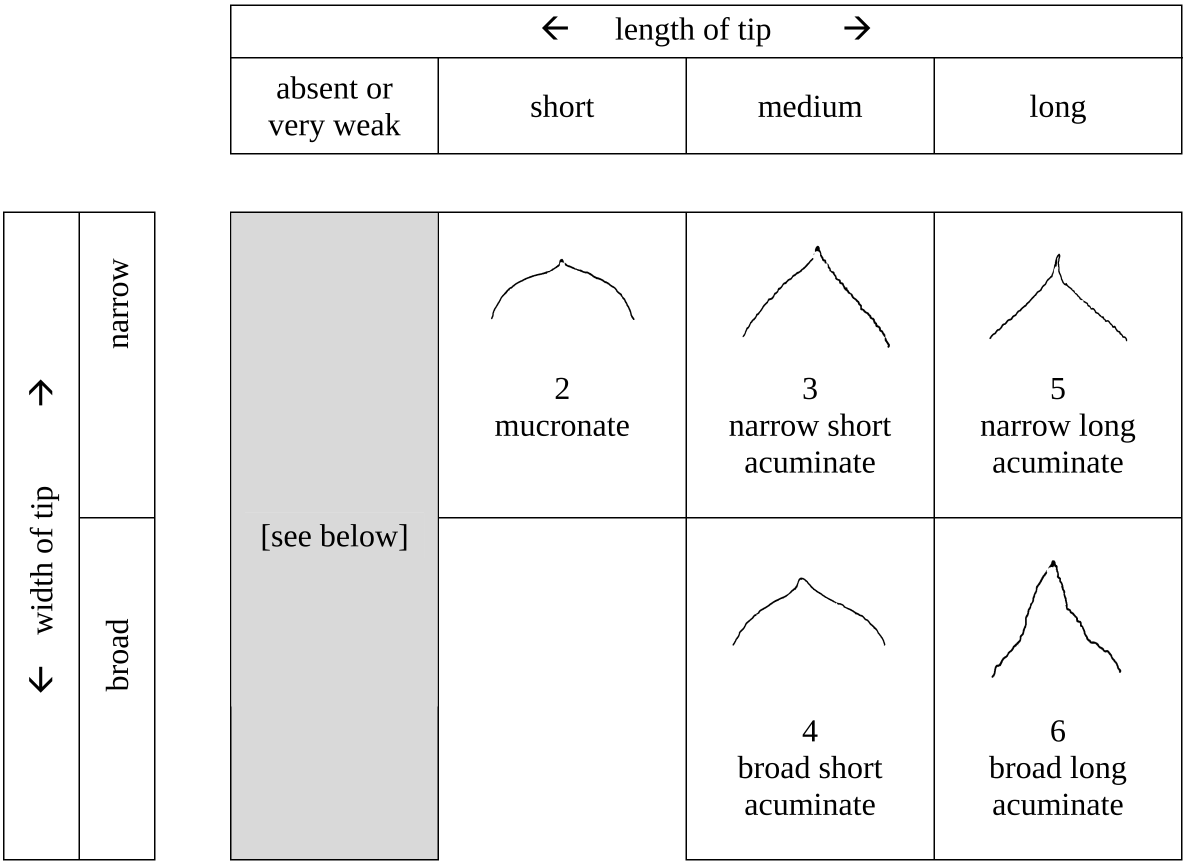
(b) length of acuminate tip (QN):
e.g. absent or short (1); medium (2); long (3)

<u>Alternative 2</u>

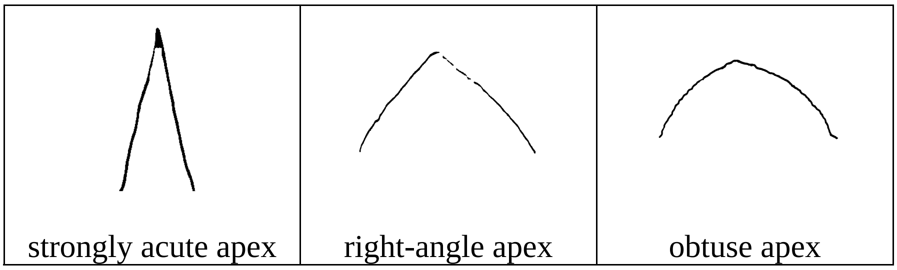
(a) angle of apex (<u>excluding tip</u>, if present) (QN):
e.g. strongly acute (1); moderately acute (2); right-angle (3); moderately obtuse (4); strongly obtuse (5)

(b) tip (PQ): *absent or very weak (1); mucronate (2); narrow short acuminate (3); broad short acuminate (4); narrow long acuminate (5); broad long acuminate (6)*

with the following illustration:



examples of tip: absent or very weak (1) with different angles of apex (characteristic (a)):

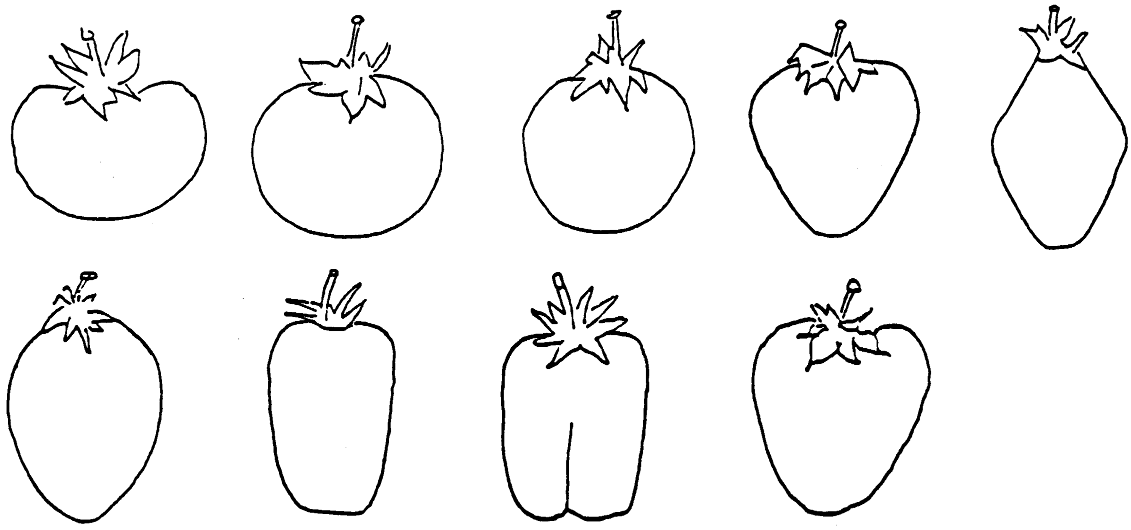


2.5 Combination of Full Plane-, Base- and Apex Shape Characteristics

The following example illustrates how the overall shape of an organ or plant part can be observed in relation to the components of shape explained in Sections 2.2 to 2.4 *[cross ref.]*.

<u>Example</u>

the range of shapes covered by the illustrations below



can be observed in relation to:

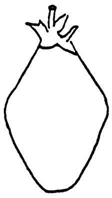
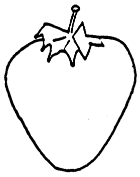
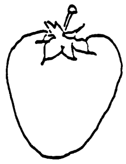
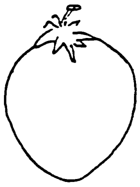
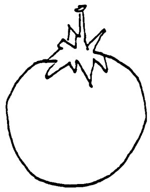
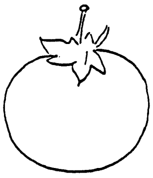
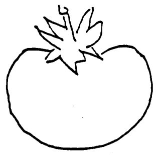
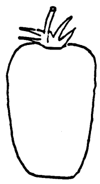
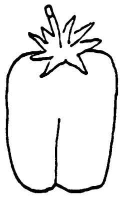
(a) ratio length/width (QN):
e.g. very elongated (1); moderately elongated (3); medium (5); moderately compressed (7); very compressed (9)

(b) position of broadest part (QN):
e.g. at middle (1); moderately towards base (2); strongly towards base (3);

(c) shape of base (QN/PQ):
e.g. pointed (1); rounded (2); depressed (3)

(d) shape of apex (QN/PQ):
e.g. pointed (1); rounded (2); truncate (3); notched (4)

The chart below illustrates how the different components cover the range of overall shapes. Such a chart is not appropriate in the Test Guidelines, although illustrations may be useful for the individual characteristics to clarify the parts to be observed.:

	shape of base				
shape of apex	pointed (1)		rounded (2)		depressed (3)
pointed (1)					
rounded (2)			 (ovate)	position of broadest part	
		ratio length/width	 (round)		
			 (oblate)		
truncate (3)					
notched (4)					

2.6 Three-dimensional shape characteristics

Wherever possible, three-dimensional plant parts should be described in cross-section as plane or two-dimensional shapes (see Section 2.1 *[cross ref.]*: ratio length/width, position of broadest part, base, shape and lateral outline), e.g. using characteristics in cross-section, lateral view, longitudinal section, etc. To describe the three-dimensional shape fully it may also be necessary to use, for example, a characteristic for hollow or solid interior in addition to the characteristics describing the plane shape. The use of characteristics for three-dimensional shapes should only be used where it is not practical to describe the characteristic in a two-dimensional way.

2.7 Symmetry

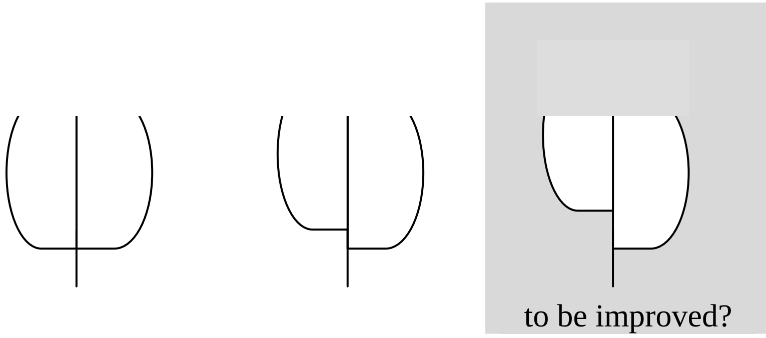
2.7.1 Lateral symmetry around the main axis may be handled in different ways. For example:

(a) lateral symmetry of plant part shapes may be considered within a particular shape, e.g. falcate and lunate are laterally asymmetric (see Section 1.4 *[cross ref.]*); or

(b) it may be appropriate to introduce symmetry as a separate characteristic. In such cases, whether the characteristic for symmetry is a qualitative (symmetric / asymmetric), a quantitative (e.g. symmetric or weakly asymmetric (1), moderately asymmetric (2), strongly asymmetric (3)) or a pseudo-qualitative characteristic needs to be considered on a case-by-case basis.

<u>Example:</u>

quantitative characteristic for symmetry



symmetric or weakly asymmetric (1)	moderately asymmetric (2)	strongly asymmetric (3)

2.8 <u>Shape:</u> types of expression and states / notes

The type of expression (i.e. qualitative, quantitative or pseudo-qualitative) of the characteristics describing components of shape needs to be considered separately for each situation. In particular, as explained in document TGP/7 “Development of Test Guidelines”, Annex 4, paragraph 1 “it should be remembered that what may appear to be very similar characteristics in different types of plant, or different organs of the same plant, may in fact be under different types of genetic control.” Thus, for example, in one type of plant, or one organ, the characteristic “position of broadest part” might be a qualitative characteristic but in another type of plant, or organ, it might be a quantitative characteristic. Therefore, the following notes are only intended to indicate the most normal situations:

(a) Ratio length/width: normally a quantitative characteristic

(b) Position of broadest part: within the same lateral outline set (e.g. rounded), this is normally a quantitative characteristic. However, where varieties cover more than one lateral outline set (e.g. angular and hastiform), the position of the broadest part is less likely to be a quantitative characteristic and is more likely to be pseudo-qualitative or qualitative;

(c) Shape of base (see Section 2.3 Base *[cross ref.]*);

(d) Shape of apex (see Section 2.4 Apex *[cross ref.]*);

(e) Lateral outline: there is no "normal" situation for the lateral outline, which can be a qualitative, quantitative or pseudo-qualitative characteristic

2.9 Shape: defining the characteristic

In the same way as for any characteristic, each characteristic should be precisely defined. With respect to shape-related characteristics it is particularly important to clarify which part of the plant is to be observed. Some illustrative examples are as follows:

Leaf: ratio length/width

- to specify if any tip (e.g. aristate tip) should be included or excluded from the observation of leaf length
- to specify if the reference point for the "base" should be the point of attachment or the lowest part of the plant part (e.g. for a cordiform leaf);
- to specify how to observe width/length in the case of laterally asymmetric shapes

Leaf: position of broadest part

- to specify if any tip (e.g. aristate tip) should be included or excluded from the observation of the position of the broadest part
- to specify if the reference point for the "base" should be the point of attachment or the lowest part of the plant part (e.g. for a cordiform leaf);
- to specify how to observe position of the broadest part in the case of laterally asymmetric shapes

2.10 Shape: Technical Questionnaire Characteristics

Where the normal requirements for a Technical Questionnaire characteristic are met (see document TGP/7 Annex 3 GN 13.3.2), characteristics developed according to the guidance set out in Sections 1.2.1 to 1.2.4 are suitable for inclusion in the Technical Questionnaire. However, document TGP/7: Annex 3 GN 13.3.3 clarifies that "[w]here necessary, characteristics in the Test Guidelines can be simplified (e.g. color groups can be created rather than requesting an RHS Colour Chart reference) for inclusion in the Technical Questionnaire (TQ), if this would be of assistance for the breeder completing the TQ. Furthermore, the characteristics contained in the Test Guidelines can be formulated in a different way, if breeders would then be able to describe them more precisely and the information would be useful for performing the test.”. Thus, in some cases, it may be appropriate to provide breeders with an opportunity to describe shape in a way which is more widely recognized. In such cases, the Technical Questionnaire may invite breeders to indicate shape on the following basis:

(a) <u>Simple Symmetric Plane Shapes</u>: to indicate the shape according to the Chart for Simple Symmetric Plane Shapes (see Section 1.3 *[cross ref.]*), e.g. narrow oblong

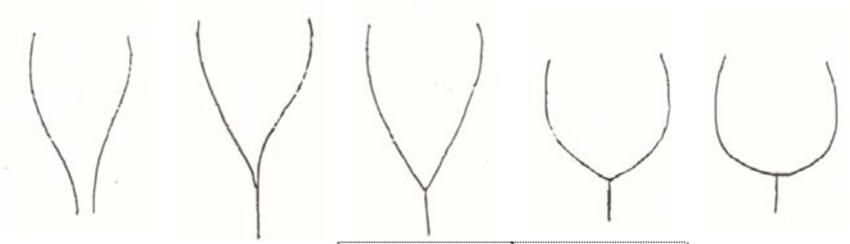
(b) <u>Non-Simple-Symmetric Plane Shapes</u>: to indicate the shape according to the non-simple-symmetric plane shapes identified in Section 1.4 *[cross ref.]*, with an indication of relative width where useful, e.g. narrow cordiform

3. Shape Illustrations

3.1 Full Plane Shapes

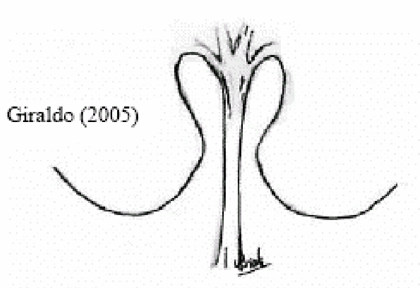
See Chart for Simple Symmetric Plane Shapes and Chart for Other Plane Shapes (Section 2.1 *[cross ref.]*)

3.2 Base Shapes

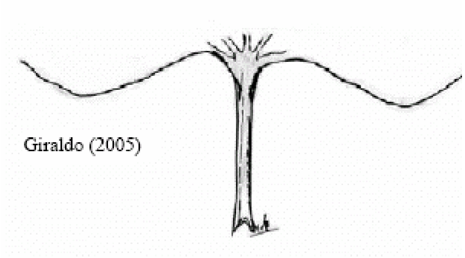


decurrent	attenuate	acute	obtuse	rounded
		cuneate		

truncate	cordate	sagittate	hastate	auriculate



calcarate
(calcarate: having a “spur”, e.g. toadflax and larkspur)



open calcarate

3.3 Apex Shapes

3.3.1 Apex


acute


obtuse

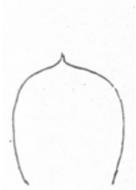

rounded


truncate


obcordate

3.3.2 Differentiated tip

length / depth of tip =>


apiculate

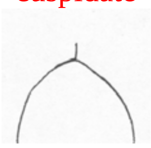

acuminate

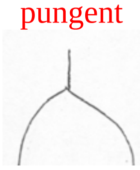

caudate

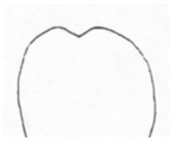

cirrhous


cuspidate


pungent


mucronate


aristate

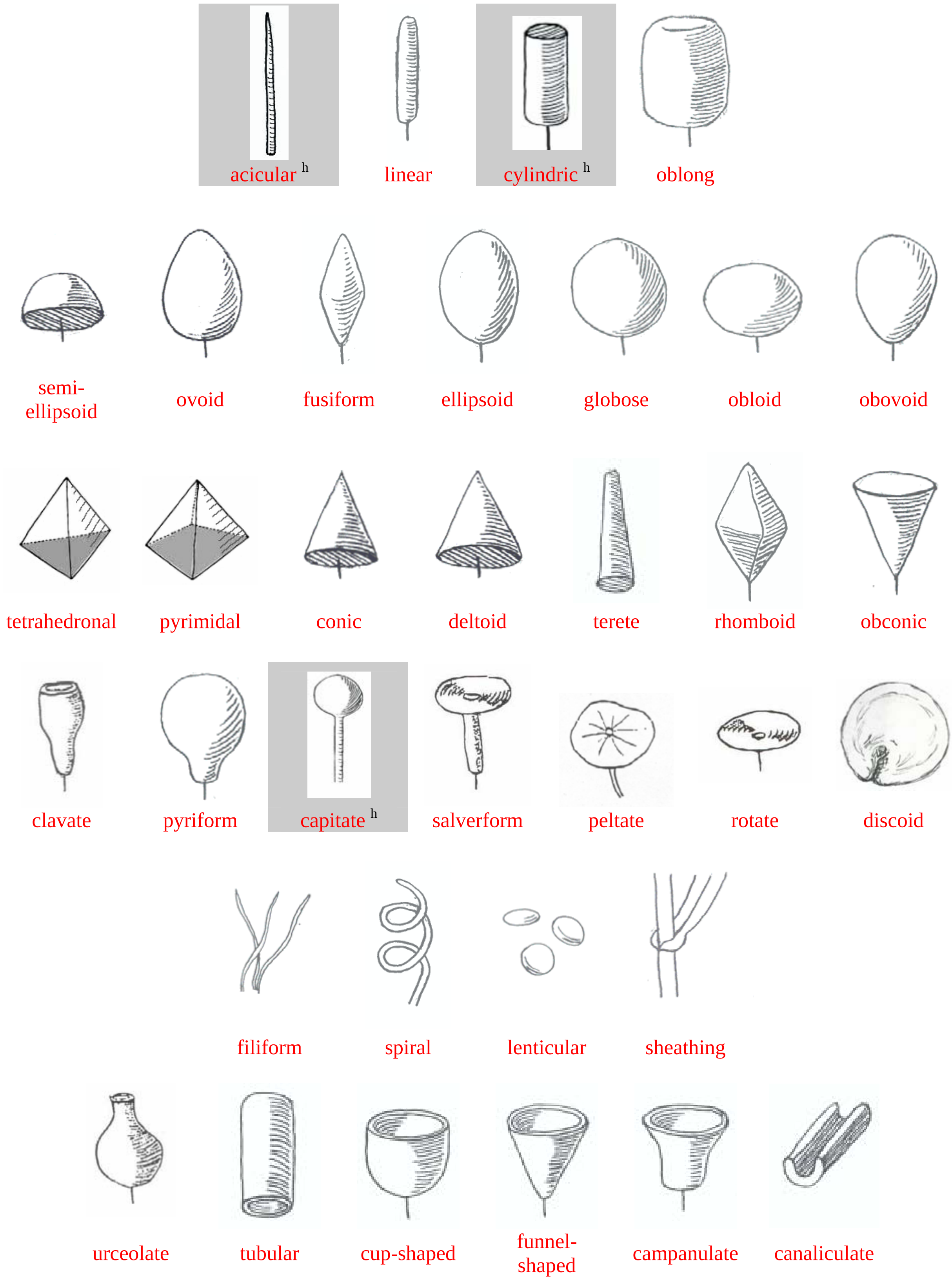

retuse


emarginate


laciniate

3.4 Three-Dimensional Shapes

[k]Note: as explained in Section 2.6, wherever possible, three-dimensional plant parts should be described in cross-section as plane or two-dimensional shapes.



3.5 Symmetry

asymmetric full shape

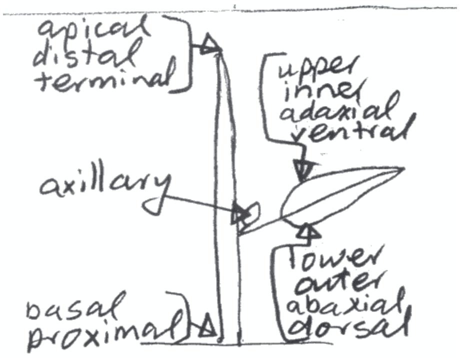
asymmetric base

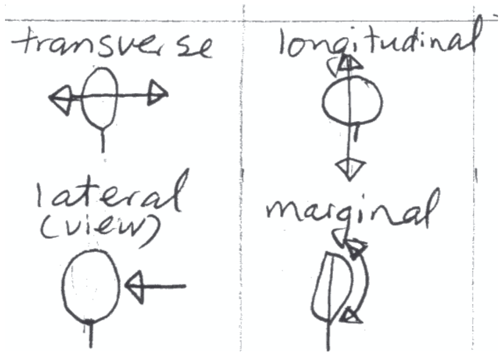
asymmetric apex

asymmetric position

II. STRUCTURE

1. Components Of Structure





[Editorial Note: New section to be developed explaining the wording of characteristic headings]

2. Developing Characteristics For Plant Structures

2.1 Growth habit

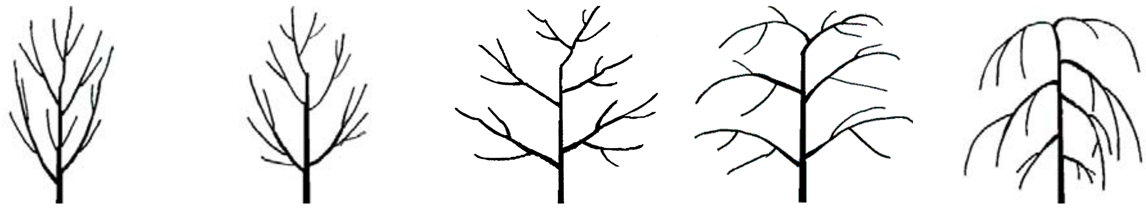
In general, the characteristic “Plant (or Tree): growth habit” is used to describe the overall growth habit of the plant, based on the deportment of the main branches or stems. The characteristic “Plant (or Tree): growth habit” is usually a quantitative characteristic. Whilst growth habit can be considered in terms of a pseudo-qualitative characteristic, it can be useful to develop quantitative or qualitative characteristics related to growth habit, rather than considering growth habit as a single pseudo-qualitative characteristic. In cases where qualitative characteristics exist, those are often presented in the form of “Plant (or Tree): type”, rather than growth habit. Explanations of “tree”, “shrub” and “semi-shrub” are provided in Section III “Definitions for Shape and Structure Terms”.[1]

Example 1: *“Plant: growth type” determinate (note 1); indeterminate (note 2)*
Example 2: *“Plant: type” climbing (note 1); non-climbing (note 2)*

Examples of “Plant (or Tree): growth habit” are provided below:

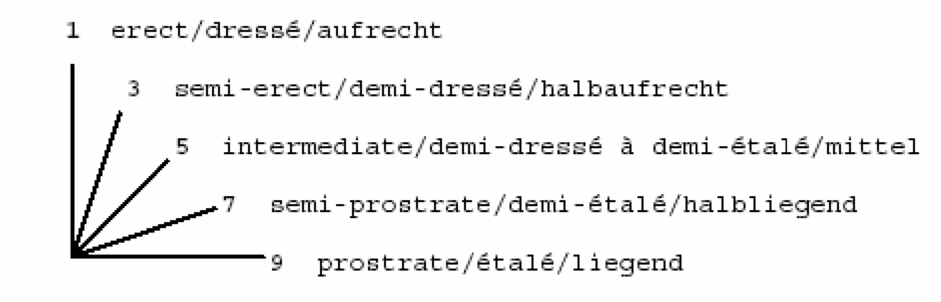
The TWA proposed to amend the examples to avoid an implication that particular growth types would have particular notes (e.g. upright (1); upright to spreading (2) spreading (3) etc.). *Office of the Union comment: possibly no change necessary because in Example 1 “spreading” has note 3; in Example 2 “spreading” has note 2, etc.*

Example 1: *quantitative characteristic*



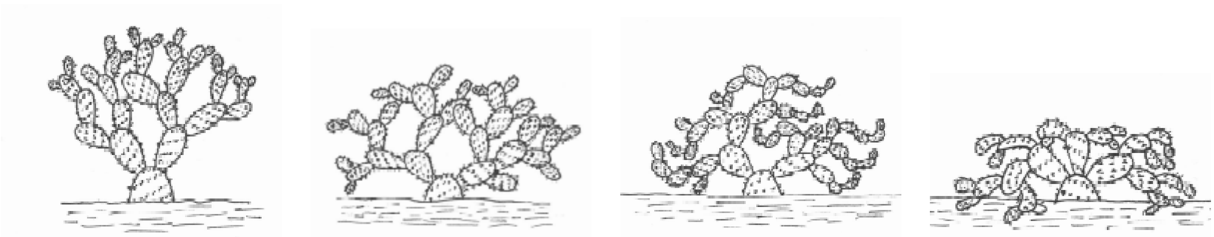
1	2	3	4	5
upright	upright to spreading	spreading	drooping	weeping

Example 2: *quantitative characteristic*



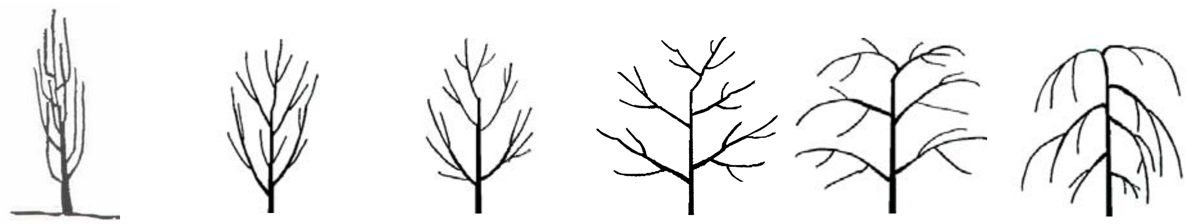
erect
semi-erect
intermediate
semi-prostrate
prostrate

Example 3: *pseudo-qualitative characteristic*



1	2	3	4
upright	spreading	decumbent	drooping

Example 4 – case 1: *pseudo-qualitative characteristic*

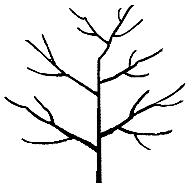
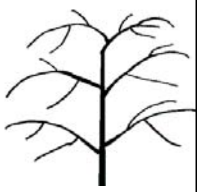


1	2	3	4	5	6
fastigiate	broad upright	broad upright to spreading	spreading	drooping	weeping

Example 4 – case 2:

(a) *qualitative characteristic* (Tree: type); and

(b) *quantitative characteristic* (Only non-fastigiate varieties: Tree: growth habit)

QL	1 fastigiate	2 non-fastigiate				
						
	QN	1 upright	2 upright to spreading	3 spreading	4 drooping	5 weeping

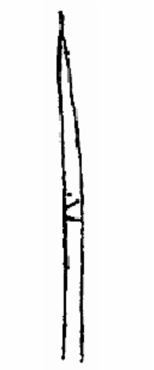
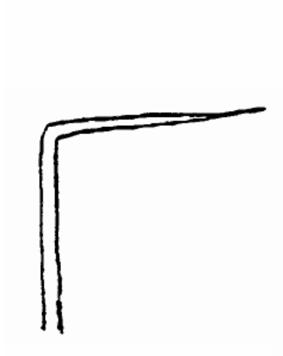
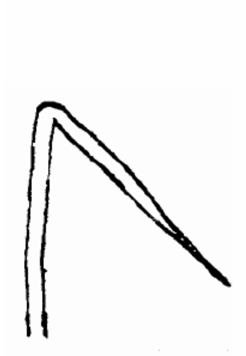
2.2 *Attitude / direction (Plant parts)*

In cases where individual plant parts are to be observed, the characteristics are, in general, presented as attitude, direction or angle with main axis, rather than habit. In a similar way to growth habit, it can be useful to develop quantitative or qualitative characteristics, rather than considering attitude and direction as a single pseudo-qualitative characteristic.

Examples of attitude as a quantitative characteristic are provided below:

Quantitative Characteristic

Example 1:

			
1 erect	2 semi-erect	3 horizontal	4 reflexed

Example 2:

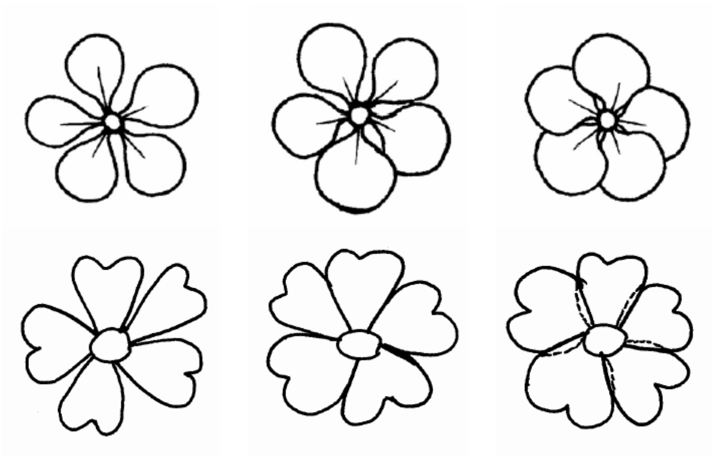


1	2	3
upwards	outwards	downwards

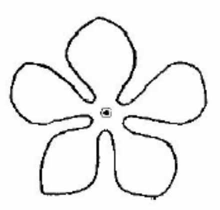
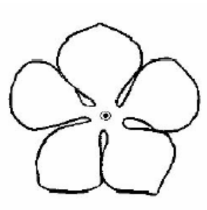
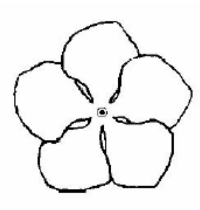
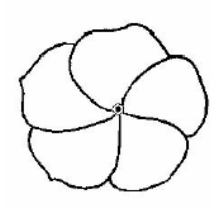
Example 3: [Note: to provide example for angle where main axis not vertical]

2.3 Relative position

A particular type of characteristic which commonly occurs in Test Guidelines is the relative position of leaves, petals, etc. The following examples can be used as guidance for the presentation of quantitative characteristics:



	1	2	3
Version 1	free	touching	overlapping
Version 2	free	intermediate	overlapping
Version 3	no overlapping	some (petals) overlapping	all (petals) overlapping

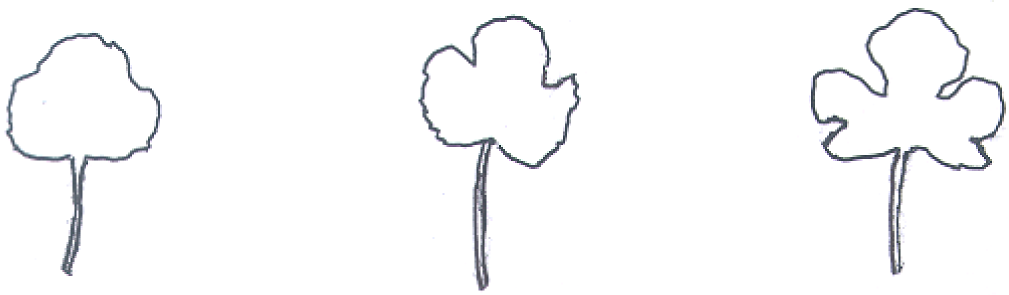





1	2	3	4
free	touching	slightly overlapping	strongly overlapping

2.4 Margins

2.4.1 It may be appropriate to have a quantitative characteristic, such as depth of incisions, rather than using botanical terms. In particular, it is not appropriate to use botanical terms in a way which indicates a qualitative characteristic when the characteristic is not qualitative. Thus, it would not be appropriate to have a characteristic with the states of expression serrate (Note 1) and dentate (Note 2), if there was not a clear discontinuity between those states.

2.4.2 Similarly, it may be appropriate to have a quantitative characteristic, such as depth of lobing, rather than trying to define a lobe. In particular, it is not appropriate to use lobing in a way which indicates a qualitative characteristic when the characteristic is not qualitative. Thus, it would not be appropriate to have a qualitative characteristic such as lobed (Note 1) and not lobed (Note 2) where there was not a clear discontinuity between those states. In the same way, a characteristic for the number of lobes could produce inconsistent results if the determination of lobes was not a qualitative characteristic. Quantitative characteristics such as depth of lobing or degree of lobing may be more appropriate, e.g.



absent or weak | medium | strong

2.5 Hairs and Spines

2.5.1 In general, botanical terms for types of hair and spine (e.g. aculeate, lanate, tomentose, etc.) are not used in the Test Guidelines, since the states of expression are likely to relate to number, density or length of hairs, spines, etc.

2.5.2 In the case of hair, the term “pubescence” is synonymous with “hairiness” for the purposes of Test Guidelines.

3. Illustrations Of Plant Structures

3.1 Habit


upright


spreading


drooping

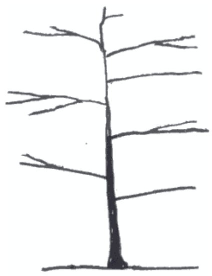

weeping


arborescent
(tree-like)

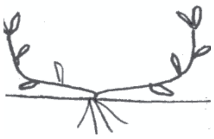

shrubby


fastigiate


columnar


divaricate


ramified

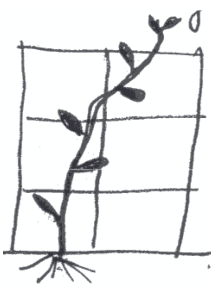

decumbent

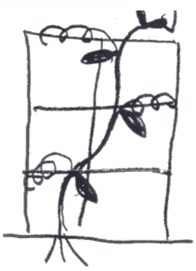

procumbent
(not rooting)

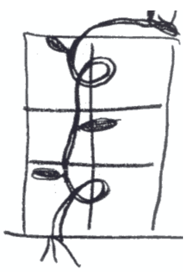

stoloniferous
(rooting)

PROSTRATE


reclining


clambering


climbing


twining

3.2 Attitude / direction (Plant parts)


adpressed


erect


semi-erect

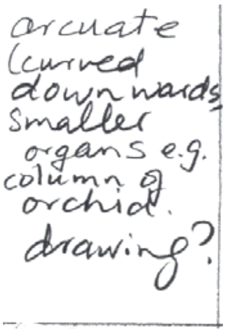

horizontal


reflexed


adpressed

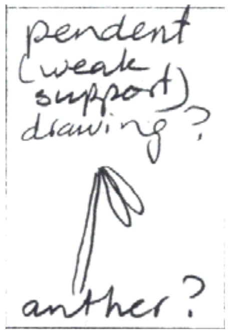

recurved

arched

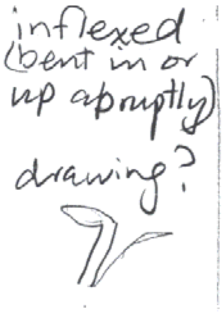


arcuate


pendulous



pendent



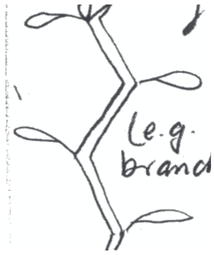
inflexed


incurved


inwards


outwards


convolute



zig-zag


involute


revolute

3.3 Relative position

exserted

included

oblique

free

contiguous
(touching – not joined)

coherent
(like parts superficially joined)

connate
(like parts histologically joined)

adherent
(unlike parts superficially joined e.g. anthers to style)

adnate
(unlike parts histologically joined e.g. anthers and style)

adpressed

sessile

stipitate
(stalked)

3.4 Types of Inflorescence [m]

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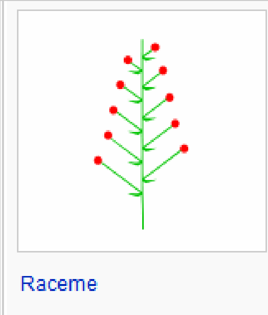
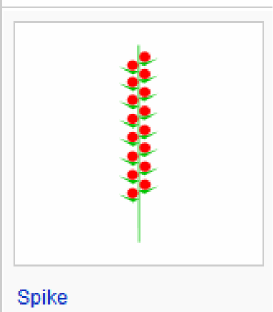
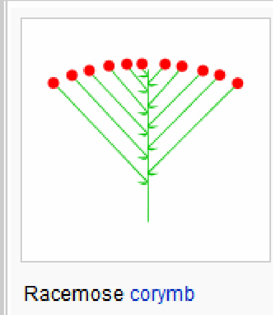
3.4.1 Simple inflorescences



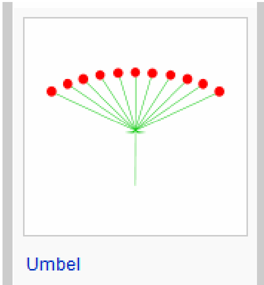
raceme



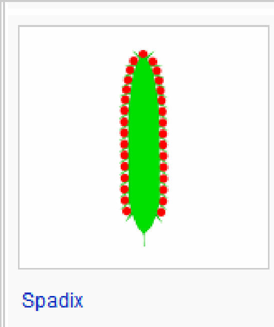
spike



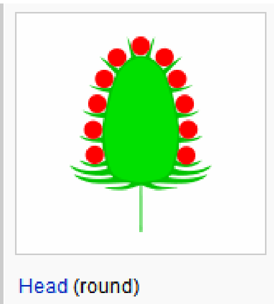
racemose corymb



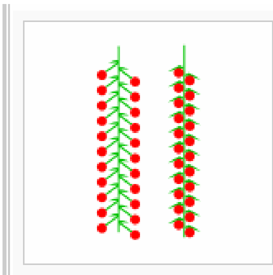
umbel



spadix

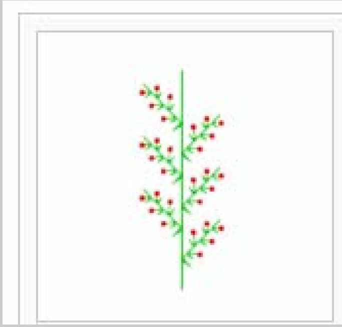


capitulum (flower head)

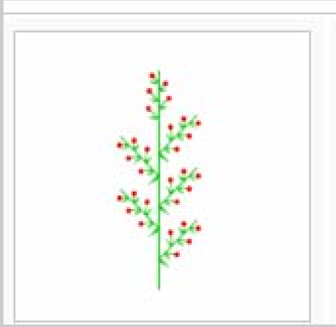


catkin

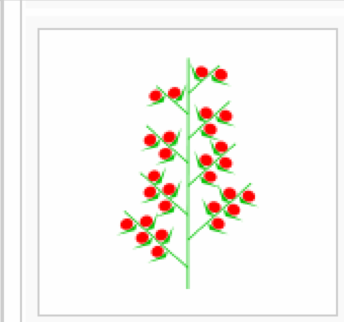
3.4.2 Compound inflorescences



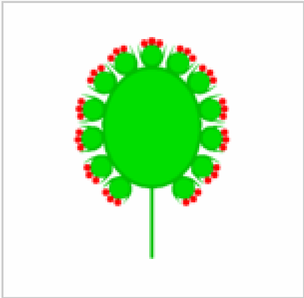
homeothetic compound raceme



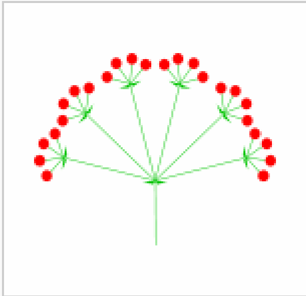
heterothetic compound raceme



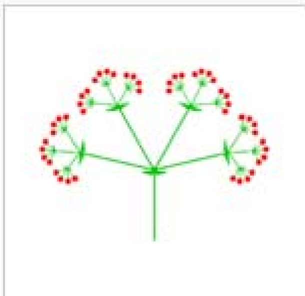
compound spike



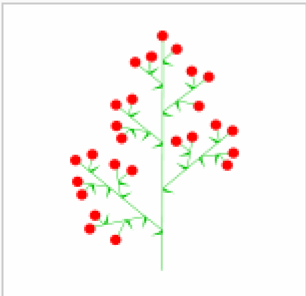
compound capitulum



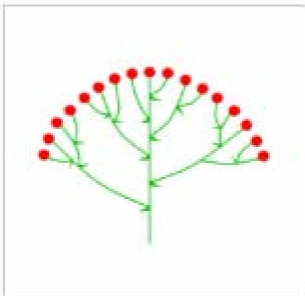
compound (double) umbel



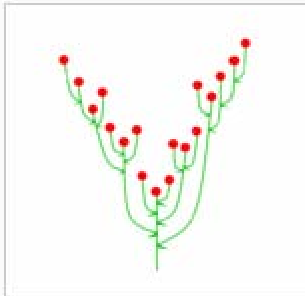
compound (triple) umbel



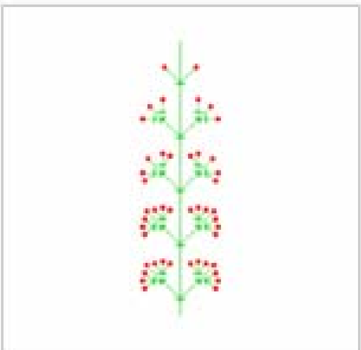
panicle



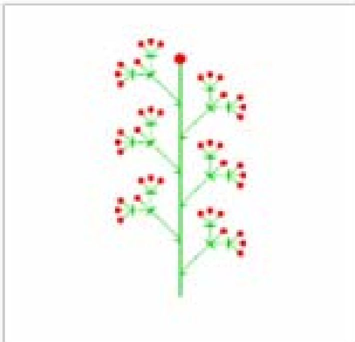
cymose corymb



anthela



thyrse

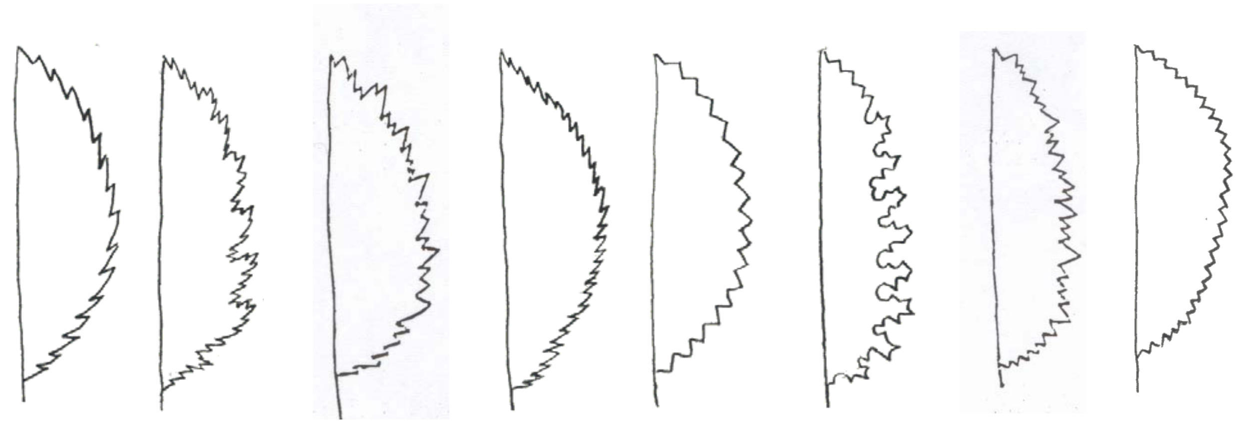


thyrsoid

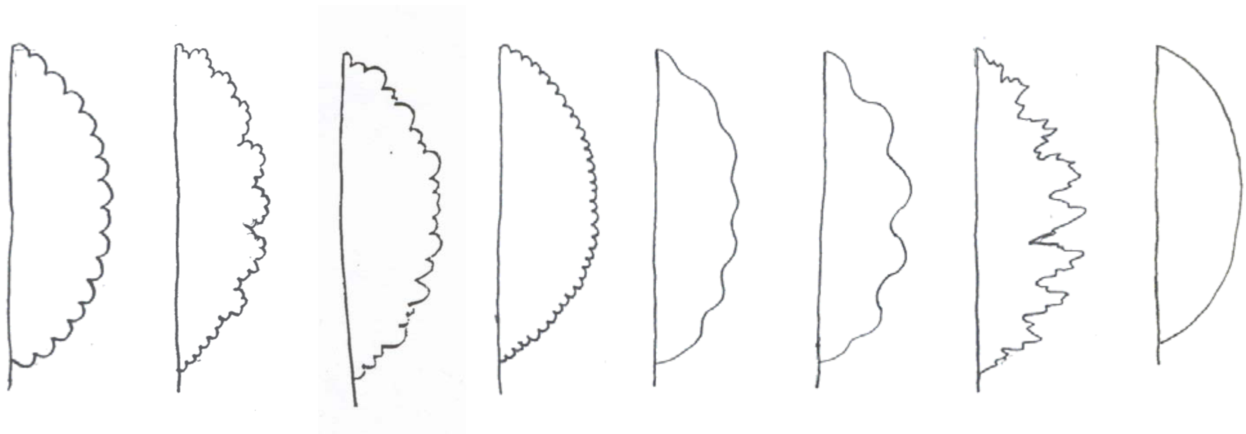
Other

The family *Asteraceae* is characterised by a highly specialized head technically called a calathid (but usually referred to as 'capitulum' or 'head'). The family *Poaceae* has a peculiar inflorescence of small spikes (spikelets) organized in panicles or spikes that are usually simply and improperly referred to as spike and panicle. The genus *Ficus* (*Moraceae*) has an inflorescence called syconium and the genus *Euphorbia* has cyathia (sing. cyathium), usually organized in umbels.

3.4 Margins



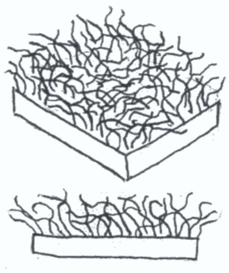
serrate | biserrate (1) | biserrate (2) | serrulate | dentate | bidentate (1) | bidentate (2) | denticulate



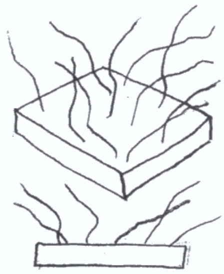
crenate | bicrenate (1) | bicrenate (2) | crenulate | repand | sinuate | erose | entire

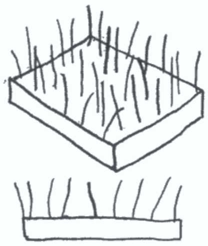
fimbriate | ciliate | crispate | undulate | involute | revolute

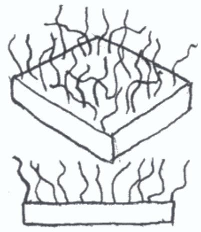
3.5 *Hairiness (Types of appendage covered by the general term "hair" in the Test Guidelines)*

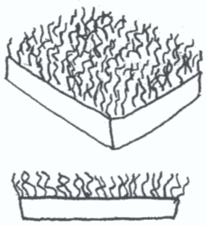

lanate

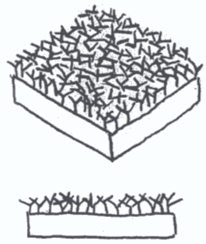

floccose

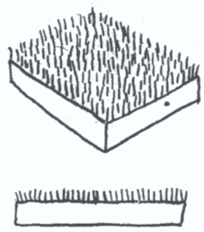

arachnoid

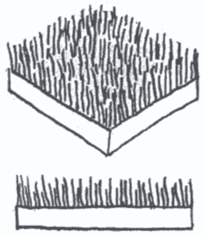

pilose

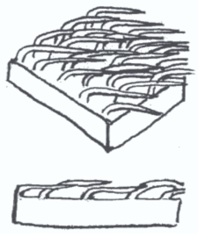

villous


tomentose

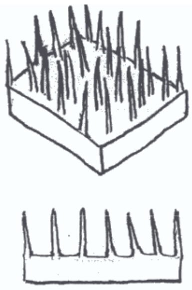

pannose

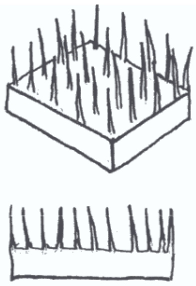

pubescent

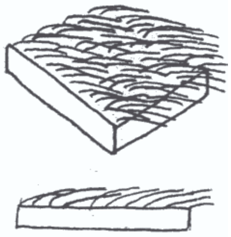

velutinous


strigose

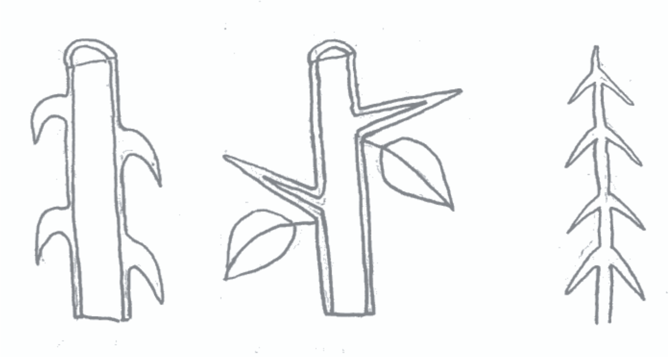

setose


hispid


hirsute

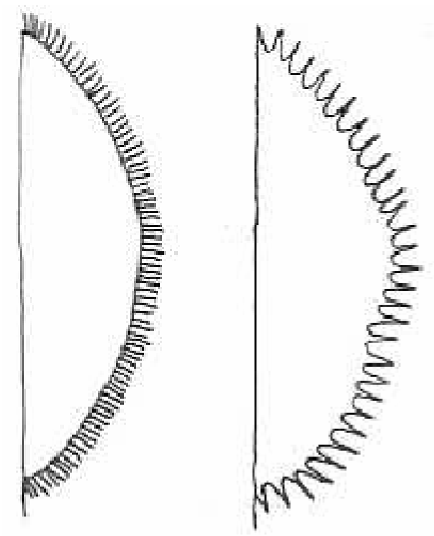

sericeous

3.6 *Spines (Types of appendage covered by the general term "spine" in the Test Guidelines)*

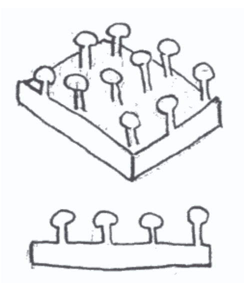


aculeate spinose barbed; barbate

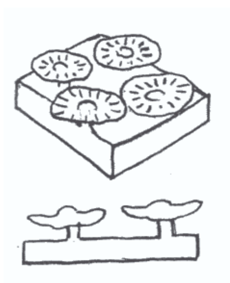
3.7 *Other appendages*



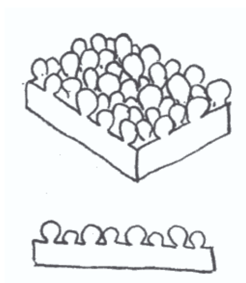
ciliate fimbriate



glandular



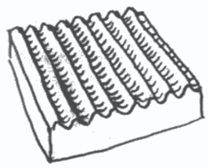
lepidote



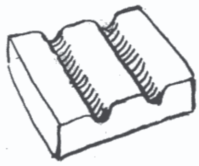
papillose

3.8 Texture

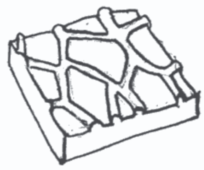
aciculate



striate



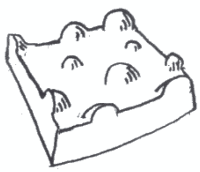
grooved



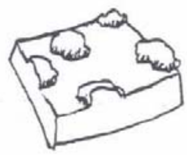
reticulate

corrugated

rugose



bullate



verrucose

III. DEFINITIONS FOR SHAPE AND STRUCTURE TERMS

Term	Definition / comment
Abaxial	The lower, outer or dorsal side; the side facing away from the axis. Compare 'adaxial'.
Acicular	Needle-shaped; rigid, long and narrow and tapering to a fine point. Round or grooved in transverse section, e.g. conifers. Applies primarily to three-dimensional shape but may also be used for the outline.
Aciculate	With fine, straight stripes, like needle scratches, lying in different directions, and of a different color or texture. Compare 'striate' (parallel lines).
Actinomorphic	Radially symmetric, so that median division in any direction will produce two equal halves, e.g. inflorescence of *Asteraceae*. Compare 'zygomorphic'.
Aculeate	Type of appendage covered by the general term "spine" in the Test Guidelines. Bearing prickles; with stiff, sharp projections from the superficial layers of the plant part. Compare 'spinose' (from the superficial and deeper layers).
Acuminate	Tapering gradually, with concave margins, to a sharp or blunt tip. Applies to the apex. Compare 'apiculate', tapering more abruptly and 'caudate', tapering more gradually, both applying to the tip only.
Acute	With an angle of less than 90 °. Applies to the base, apex, etc. Compare 'obtuse' where the angle is >90 °. In cases where it is useful to distinguish between 'narrow acute' and 'broad acute', one should remember that they should both still be <90 °.
Adaxial	The upper, inner or ventral side; the side facing the axis. Compare 'abaxial'.
Adherent	Dissimilar plant parts in close contact, e.g. anthers adherent to style. Compare 'adnate', 'coalesced', 'coherent', connate', 'contiguous'.
Adnate	Dissimilar plant parts fused histologically, e.g. stamens implanted onto the corolla. Compare 'adherent', 'coalesced', 'coherent', 'connate', 'contiguous'.
Adpressed	Lying close to or flat against the surface or another organ.
Anthela [m]	a cymose corymb with the lateral flowers higher than the central ones.
Apex	The apex (apical or distal part) of an organ or plant part is the end furthest from the point of attachment. The shape of the apex is taken as the general shape, excluding any differentiated tip (if present)
Apical	Located at the apex and/or furthest from the position of attachment. Compare 'proximal', 'basal' which is closest to the position of attachment. Synonyms: Apical, Distal, Terminal (most appropriate term to be decided on a case-by-case basis)
Apiculate	Terminating abruptly in a small sharp but not rigid point which is both vascular and laminar in nature. Applies to the most distal part of the apex (tip). Compare 'acuminate' where the tapering is less abrupt and 'cuspidate' which is rigid.
Apopetalous	With separate petals; petals not fused into a corolla tube. Compare 'sympetalous'.
Arachnoid	Covered by the general term "hair" in the Test Guidelines. Cobwebby; with loosely tangled, long, fine, white hair.
Arborescent	Tree-like; large woody plant, usually with a single main stem (trunk).

Term	Definition / comment
Arched, Arching	Strongly curved more or less symmetrically, as an arch.
Aristate	Awned; bearing a stiff, straight, bristle-like continuation of the primary vein. Applies to the most distal part of the apex (tip) or used for other parts where bristles may occur. Compare 'mucronate' where the point is shorter.
Ascending	use "upwards"
Asymmetric	Not being capable of median division into two equal halves in any direction.
Attenuate	Tapering gradually, with lateral margins concave. Generally more tapered than 'acute'. Applies to the base. Compare 'acuminate' which applies to the apex.
Attitude	For UPOV purposes, 'attitude' is used for plant parts, while 'growth habit' is used for the whole plant. 'Attitude' is used in relation to soil level and to other plant parts. Rather to use 'attitude' instead of 'stance'.
Auriculate	Eared; with two rounded lobes directed outwards to either side and projecting beyond the general outline of the plant part. Applies to the base. Compare 'hastate' with triangular lobes directed outwards, and 'sagittate' with triangular lobes directed downwards. Compare 'auriculiform' which applies to full plane shape.
Auriculiform	Eared; with two rounded basal lobes directed outwards and projecting beyond the general outline of the plant part. Compare 'auriculate' which applies to the base.
Axillary	Situated within or arising from the axil, which is the upper angle between the axis and any lateral off-shoot, e.g. an axillary bud arising from the axil of a leaf.
Barbate	See 'barbed'
Barbate	Bearded; with tufts of long hairs.
Barbed	Terminating in a reflexed hook.
Barbed	Type of appendage covered by the general term "spine" in the Test Guidelines. With short, rigid, hooked to reflexed bristles or points, like the barb of a fish-hook.
Basal	Located at the base, closest to the position of attachment. Compare 'apical', 'distal', 'terminal'. Synonyms: Basal, Proximal (most appropriate term to be decided on a case-by-case basis)
Base	The base (proximal part) of a plant part is the end nearest to the point of attachment.
Bearded	See 'barbate'.
Bicrenate	Doubly crenate; with the crenations themselves crenate, or with alternating larger and smaller crenations.
Bidentate	Doubly dentate; with the dentations themselves dentate, or with alternating larger and smaller dentations.
Biserrate	Doubly serrate; with the serrations themselves serrate, or with alternating larger and smaller serrations.
Blistered	use 'bullate'.
Bristly	With stiff, strong trichomes. A general term including both 'hispid' (harsh to the touch) and 'setose' (spiny to the touch).

Term	Definition / comment
Bullate	Blistered; the surface covered with irregular blister-like convexities. Compare ‘papillose’ with more elevated, nipple-like projections and ‘verrucose’ which is warty.
Bumpy	A general term for a surface with rounded lumps or swellings.
Campanulate	Bell-shaped; with an inflated tube, gradually widening distally into a limb or lobes. Normally applies to the corolla. Compare ‘funnel-shaped’ which is not inflated basally and ‘cup-shaped’ which does not diverge distally.
Canaliculate	Channeled, gutter-shaped; long and narrow, with a longitudinal groove.
Capitate	Headed; refers to a plant part which is stalked and terminates in a knob. Also applies to an inflorescence type with crowded flowers (florets) borne in a head-like cluster, e.g. Asteraceae.
Capitulum (flower head) [m]	A flower head or capitulum is a very contracted raceme in which the single sessile flowers share are borne on an enlarged stem. It is characteristic of *Dipsacaceae*.
Cartilaginous	Firm and tough, like cartilage. Compare ‘coriaceous’ which is more flexible.
Catkin (ament) [m]	A catkin or ament is a scaly, generally drooping spike or raceme. Cymose or other complex inflorescences that are superficially similar are also generally called thus.
Caudate	Tailed; tapering to a long, narrow, pointed appendage which is both vascular and laminar in nature. Applies to the most distal part of the apex (tip). Compare ‘acuminate’ where the point is shorter.
Ciliate	Bearing a marginal fringe of fine trichomes (outgrowths from the epidermis). Compare ‘fimbriate’ which arises not only from the epidermis but from the deeper layers as well.
Circular	Round; length/width ratio as well as dimension in all directions 1:1. The term ‘circular‘ is preferable to ‘round’ and ‘orbicular’ for UPOV use. Forms part of the ‘elliptic’ series. Also applies to arrangement. Compare ‘rounded’ which applies to part of an outline, not the full shape.
Cirrhous	With a tendril; terminating in a narrow spiralled tip which is a continuation of the primary vein. Applies to the most distal part of the apex (tip) or to other parts with tendrils.
Clambering	Climbing without the aid of special structures e.g. tendrils. Compare ‘climbing’.
Clavate	Club shaped - shaped like a club; thickening towards the apex from a tapered base
Clawed	Abruptly contracted to a narrow, petiole-like basal portion. Applies to petals and sepals. Compare ‘spatulate’ which narrows more gradually towards the base.
Climbing (Climber)	Climbing by means of special structures e.g. tendrils. Compare ‘clambering’.
Clustered	Clumped; closely grouped, arising from a common point.
Coalesced	Unlike plant parts partially and irregularly fused. Compare ‘adherent’, ‘adnate’, ‘coherent’, ‘connate’, ‘contiguous’.
Coarse	use ‘rough’.
Coherent	Similar plant parts in close contact, not fused, e.g. anthers clinging together. Compare ‘adherent’, ‘adnate’, ‘coalesced’, ‘connate’, ‘contiguous’.

Term	Definition / comment
Columnar	Upright, with a dominant main stem and suppressed branch development. Compare ‘fastigiate’ where the branch development is not suppressed.
Compressed	Flattened laterally or lengthwise. Compare ‘depressed’.
Concave	Hollowed; curved inwards.
Congested	Densely crowded; with almost no intervening spaces. Compare ‘crowded’ which is less dense.
Conic	Cone-shaped; tapering evenly from a circular base to an acute apex. Length/diameter ratio of the basic shape: 2:1 to 1,5:1. The conic series also includes ‘deltoid’, with a more specific length/diameter ratio. Compare ‘triangular’ which applies to two-dimensional shape and ‘obconic’ which narrows towards the base.
Connate	Like parts fused histologically, e.g. staminal filaments fused into a tube. Compare ‘adherent’, ‘adnate, ‘coalesced’, ‘coherent’, ‘contiguous’.
Connivent	Converging but not fused, e.g. stamens with anthers touching.
Contiguous	Touching but not fused. Not ‘adnate’, ‘connate’, ‘adherent’ or ‘coherent’.
Continuous	In an uninterrupted arrangement. Compare ‘interrupted’.
Convex	Rounded and curved outwards.
Convolute	Rolled up longitudinally with the plant parts overlapping, as petals in a bud.
Cordate	Heart-shaped; with two equal, rounded, basal lobes divided by a deep sinus. Compare ‘obcordate’ which has the sinus at the apex and ‘cordiform’ which applies to full plane shape.
Cordiform	Heart-shaped; with two equal, rounded, basal lobes divided by a deep sinus, and tapering fairly straightly to the apex. Compare ‘cordate’ which applies to the base and ‘obcordate’ which is broadest towards the apex.
Coriaceous	Leathery; thick, tough and flexible. Compare ‘cartilaginous’ which is more firm.
Corrugated	Wrinkled, crumpled or folded into alternating furrows and ridges, e.g. *Papaver* petals in the bud. Compare ‘rugose’.
Crenate	Scalloped, with rounded teeth.
Crenulate	having a margin with *small* rounded teeth (minutely crenate). Compare “crenate”.
Crispate	With the margin curled or crumpled and irregularly twisted.
Crowded	Grouped together but with some intervening spaces. Compare ‘congested’ which is more densely crowded.
Crustaceous	Thin, hard and brittle.
Cuneate	Wedge-shaped; broadest towards the apex, the lateral margins more or less straight and converging towards the base at an acute or obtuse angle. Applies to the base.
Cuneiform	use ‘obconic’
Cup-Shaped	With a tube which is rounded basally and which does not diverge distally. Compare ‘campanulate’ which diverges distally and ‘funnel-shaped’ which is not rounded basally.

Term	Definition / comment
Cuspidate	Terminating in a short rigid point, or cusp, which is both vascular and laminar in nature. Applies to the most distal part of the apex (tip). Compare ‘mucronate’ which is only vascular, ‘apiculate’ where the point is not rigid and ‘pungent’ where the point is long and rigid.
Cylindric	Solid, long and narrow with an even diameter, circular in transverse section. Compare ‘tubular’ which is hollow.
Cymose corymb [m]	The so called cymose corymb is similar to a racemose corymb but has a panicle-like structure.
Decumbent	Growing horizontally on the ground but with the apical parts ascending. Compare ‘prostrate’ where the apical parts do not ascend.
Decurrent	Running downwards; ~~[with the base of the leaf blade prolonged downwards onto the stem as a wing. Applies to the base of a leaf blade.]~~ ASL also used for vegetative bud supports in plum – this must be part of the stem I think.
Deflexed	use ‘reflexed’.
Deltate	More or less equilaterally triangular; narrowing towards the apex, that is away from the point of attachment. Length/width ratio of the basic shape: 1:1, same as ‘very broad triangular’. Forms part of the ‘triangular’ series. Compare ‘deltoid’ which applies to three-dimensional shape, also compare obtriangular’ and ‘obdeltate’ which narrow towards the base.
Deltoid	More or less equilaterally cone-shaped; tapering evenly from a circular base to an acute apex. Length/diameter ratio of the basic shape: 1:1, same as ‘very broad conic’. Forms part of the ‘conic’ series. Compare ‘deltate’ which applies to two-dimensional shape and ‘obdeltoid’ which narrows towards the base.
Dense (Density)	Numerous per unit area, as opposed to sparse.
Dentate	With sharp teeth pointed outwards. The two sides of a tooth are the same length. Compare ‘denticulate’ which is finer, ‘crenate’ where the teeth are rounded and ‘serrate’ where the teeth point towards the apex.
Denticulate	With *fine*, sharp teeth pointed outwards (finely dentate). Compare “dentate”.
Depressed	Sunken, as if pressed into the middle from above or from above and below, causing a concavity. Compare ‘compressed’.
Descending	Growing or orientated gradually downwards in relation to soil level or to other plant parts. Synonyms: Descending, Downwards (most appropriate term to be decided on a case-by-case basis)
Diffuse	With plant parts, e.g. petals, spread widely, or with branches spread widely and frequently branching. Compare ‘divergent’, spreading at almost right angles to the main axis.
Discoid	Having a flat, circular form; disk-shaped.
Distal	Located at the apex and/or furthest from the position of attachment. Compare ‘proximal’, ‘basal’ which is closest to the position of attachment. Synonyms: Apical, Distal, Terminal (most appropriate term to be decided on a case-by-case basis)

Term	Definition / comment
Distinct	to be used only in terms of the meaning within DUS …
Divaricate	With branches spreading widely, at almost right angles to the main axis. 'Divaricate' applies more specifically to the growth habit while 'divergent' applies to the direction of the branches. 'A divaricate plant would have divergent branches.
Divergent	With plant parts, specifically branches, spreading away from each other. Compare 'diffuse' and 'divaricate'. 'Divaricate' applies more specifically to the growth habit while 'divergent' applies to the direction of the branches. 'A divaricate plant would have divergent branches.
Dorsal	The lower, outer or abaxial side in relation to the axis. Compare 'ventral'.
Downwards	Growing or orientated gradually downwards in relation to soil level or to other plant parts. Synonyms: Descending, Downwards (most appropriate term to be decided on a case-by-case basis)
Drooping	Bending downwards. Compare 'weeping' where the downward bending is more pronounced and 'pendulous' which is hanging, rather than bending downwards. Also used for growth habit.
Dwarfed (Dwarf)	A plant or part of a plant of which the growth is suppressed, leading to a much reduced size compared to the average of its kind.
Ellipsoid	A three-dimensional ellipse; broadest at the middle, with margins tapering convexly and evenly to either end. Length/diameter ratio of the basic shape: 2:1 to 1,5:1. The 'ellipsoid' series also includes 'spheric' and 'obloid', differing only in their length/diameter ratios. Compare 'elliptic', 'circular' and 'oblate' which apply to two-dimensional shapes.
Elliptic	Ellipse-shaped; broadest at the middle, the margins tapering convexly and evenly to either end. Length/width ratio of the basic shape: 2:1 to 1,5:1. The elliptic series also includes 'circular' and 'oblate', differing only in their length/width ratios.
Emarginate	Notched; with an acute, deep, central sinus. Applies to the apex. Compare 'retuse' and 'obcordate'.
Entire	With an undivided margin; not toothed or lobed.
Equilateral	With sides or halves of equal shape and/or size. Compare 'inequilateral'.
Erect	Vertical in relation to the ground or perpendicular to the surface where the plant part is attached. For UPOV purposes 'erect' is used for plant parts only (attitude) and not for the whole plant (habit). The term to be used for plant habit is 'upright'.
Erose	Gnawed; with an irregularly toothed margin, as if chewed.
Even	Smooth; opposite of rough. For internal texture characteristics the term 'fine' is used.
Exserted	Extending beyond the surrounding parts, e.g. stamens protruding beyond the corolla. Compare 'included'.
Falcate	Sickle-shaped; strongly curved sideways.

Term	Definition / comment
Farinaceous (Farinose)	Mealy; with a whitish, powdery covering. Compare 'granular'.
Fasciated	With stems fused together and congested lengthwise, malformed and flattened; e.g. stems of pea.
Fastigiate	Strongly upright, with a narrow crown, the branches virtually erect, parallel and adpressed. Applies to trees. Compare 'columnar' of which the branch development is suppressed.
Felted	use 'pannose'.
Fibrous	With tough strands.
Filiform	'Thread-like'.
Fimbriate	Bearing a marginal fringe of hair-like appendages extending not only from the epidermis but from the deeper layers as well. Compare 'ciliate' which arises from the epidermis only.
Fine	Not textured; smooth, opposite of 'rough'. For surface characteristics the term 'smooth' or 'even' is used.
Flabellate (fan shape) [f]	Fan shaped; rounded at the apex and flattened at the base.
Fleshy	Pulpy; succulent but firm, easy to cut.
Flexuous	(a) Resiliently bendable, like a whip / lithe or fluid in movement; or (b) Having curves, turns or bends
Floccose	Covered by the general term "hair" in the Test Guidelines. With tufts of long, soft hairs, usually rubbing off easily.'
Form	in the UPOV Test Guidelines, the term "shape" should be used in its broadest sense and the use of terms such as "form" and "profile" should be avoided to minimize discrepancies in translation
Free	Separate from one another; not joined.
Funnel-Shaped (Infundibular)	With an obconic tube gradually diverging distally. Compare 'campanulate' and 'cup-shaped' which are rounded basally.
Fusiform	Spindle-shaped; long and narrow, circular in transverse section, thick in the middle and tapering to both ends.
Glabrate	Almost hairless.
Glabrescent	Becoming hairless with age.
Glabrous	Bald; without trichomes, smooth, hairless.
Glandular	Bearing glands; with short-stalked or sessile glands or with hairs bearing glands at their tips.
Globose	Ball-shaped; round in outline when viewed from any angle.
Granular (Grainy)	Covered with small granules or grains. Compare 'farinaceous'.
Grooved	With one or more narrow channels

Term	Definition / comment
Hastate	Arrow-shaped; with two equal, more or less triangular lobes directed outwards to either side. Applies to the base of a leaf blade. Compare ‘auriculate’ with rounded lobes directed outwards, ‘sagittate’ with triangular lobes directed downwards and ‘hastiform’ which applies to full plane shape.
Hastiform	Arrowhead-shaped; gradually enlarged basally from an acute apex, but with two widely divergent basal lobes, directed outwards. Compare ‘hastate’ which applies to the base and ‘sagittate’ of which the lobes are directed downwards.
Herbaceous (Herb)	Plant with soft, non-woody stems, of which the above-ground parts die back after the growing season, or, more generally, any non-woody plant.
Hirsute	Covered by the general term “hair” in the Test Guidelines. With long, more or less erect, coarse, stiff trichomes. Compare ‘setose’ which is spiny to the touch and ‘hispid’ which is coarser. EB: I could not find clear differences between ‘hirsute’ and ‘hispid’, except that ‘hirsute’ seems to be somewhat finer. ASL I think hairs are rough and coarse but do not have to be stiff.
Hispid	Covered by the general term “hair” in the Test Guidelines. With stiff, bristly trichomes; harsh to the touch. Compare ‘setose’ which is spiny to the touch, ‘hirsute’ which is somewhat finer and ‘scabrous’ which is also harsh to the touch.
Horizontal	Level; parallel to the ground. To be used in relation to soil level, i.e. perpendicular to ‘vertical’. To be used for plant parts and not for growth habit. ‘Prostrate’ is to be used for habit. ‘Adpressed’ is preferable for plant parts lying flat on a surface, therefore not necessarily parallel to the ground.
Included	Enclosed within; not extending beyond the surrounding parts, e.g. stamens not sticking out beyond the corolla. Compare ‘exserted’.
Incurved	Curving inwards or upwards (adaxially). Compare ‘inflexed’, which is bent inwards or upwards more abruptly.
Indistinct	not to be used (see “distinctness”)
Inequilateral	With sides or halves of unequal shape and/or size; oblique. Compare ‘equilateral’.
Inflated	Blown up; hollow and swollen in appearance.
Inflexed	Bent inwards or upwards (adaxially) abruptly. Compare ‘incurved’.
Infundibular	See ‘funnel-shaped’.
Interrupted	Not continuous; an arrangement which is disturbed at some point/points. Compare ‘continuous’.
Intricate	Entangled; irregularly intertwined.
Involute	With margins rolled towards the adaxial surface. Compare ‘revolute’ with margins rolled downwards.
Inwards	a plant part/plant parts facing inwards in relation to the whole plant or in relation to other relevant plant parts, e.g. stamens facing inwards in relation to the corolla. Compare ‘outwards’.
Kidney-shaped	Synonyms: Reniform, Kidney-shaped (most appropriate term to be decided on a case-by-case basis)

Term	Definition / comment
Lanate	Covered by the general term "hair" in the Test Guidelines. Woolly; with long, somewhat matted, tangled trichomes. Compare 'tomentose' with shorter, denser hairs and 'pannose' which is even denser (felted).
Lanceolate	Lance-shaped; narrow ovate, broadest towards the base, that is towards the point of attachment. The apex may have a sharp or blunt tip. Length/width ratio 6:1 to 3:1, same as 'narrow ovate'. Forms part of the 'ovate' series
Lateral	Towards or at the side of an axis or plant part.
Lax	Loose; not compact, in an open arrangement.
Lenticular	Lens-shaped; doubly convex.
Lepidote (Leprous)	Peltate-scaly; with small stalked scales.
Ligneous	Woody.
Ligulate (Lorate)	Strap-shaped; long and narrow, with the lateral margins parallel. Length/width ratio 6:1 to 3:1, same as 'narrow oblong'. Forms part of the 'oblong' series.
Linear	Long and narrow, with the lateral margins parallel. Length/width ratio more than 6:1, same as 'very narrow oblong'. Forms part of the 'oblong' series.
Lobe, Lobed	See Part II, Section 2.4.2 *[cross ref.]*: in general, terms such as 'lobed' (cut 1/8 to ¼ of the distance to the middle), 'cleft' (cut 1/4 to ½ way to the middle), 'parted' (cut ½ to ¾ way to the middle) and 'divided' (cut ¾ way to almost all the way to the middle) are not used because they can be misleading if used as states of expression
Longitudinal	Parallel to the axis extending through the base and the apex, whether or not this is the longest axis.
Lorate	See 'Ligulate'
Lunate	Crescent-shaped with more or less acute ends. Compare 'reniform'.
Lyrate	Lyre-shaped: pinnately lobed, with the terminal lobe much larger than the more basal (lower) lobes.
Marginal	Associated with the margin or edge of an organ.
Membranous	Like a membrane; thin and somewhat transparent. Compare 'papyraceous' which is more opaque.
Mucronate	Terminating abruptly in a short, hard point which is a continuation of the primary vein and is only vascular in nature. Applies to the most distal part of the apex (tip). Compare 'aristate' where the point is longer and 'cuspidate' which is both vascular and laminar.
Obconic	Inversely conic; tapering evenly from a circular apex to an acute base. Length/diameter ratio of the basic shape: 2:1 to 1,5:1. The obconic series also includes 'obdeltoid', with a more specific length/diameter ratio. Compare 'obtriangular' which applies to two-dimensional shape and 'conic' which narrows towards the apex.

Term	Definition / comment
Obcordate	Inversely heart-shaped; with two equal, rounded, apical lobes divided by a deep sinus, and tapering fairly straightly to the base. Applies to full plane shape and the general shape of the apex. Compare 'cordate' which has the sinus at the base and 'obcordiform' which applies to full plane shape. Also compare 'emarginate' and 'retuse' where the incisions are too small to affect the general shape.
Obcordiform	Inversely heart-shaped; with two equal, rounded, apical lobes divided by a deep sinus, and tapering fairly straightly to the base. Compare 'obcordate' which applies to the apex and 'cordiform' which is broadest towards the base.
Obdeltate	Inversely deltate; more or less equilaterally obtriangular, narrowing towards the base, that is towards the point of attachment. Length/width ratio of the basic shape: 1:1, same as 'very broad obtriangular'. Forms part of the 'triangular' series. Compare 'obdeltoid' which applies to three-dimensional shape and 'deltate' which narrows towards the apex.
Oblanceolate	Inversely lanceolate; broadest towards the apex, that is furthest from the point of attachment. Length/width ratio 6:1 to 3:1, same as 'narrow obovate'. Forms part of the 'obovate' series.
Oblate	Transverse elliptic; ellipse shaped but shorter than broad, broadest at the middle, with margins tapering convexly and evenly to the base and apex, the longest dimension orientated transversely. Length/width ratio of the basic shape:1:1,5 to 1:2. Forms part of the 'elliptic' series.
Oblique	Oblique to symmetry
Oblique	Orientated at an angle other than 90 degrees to or parallel to the longitudinal axis. Applies to the base, apex, two-dimensional outline, position and attitude in relation to plant parts. In some cases the term refers to the shape or symmetry of a plant part, while in others it refers to the position.
Oblique	Orientation of plant part: Orientated at an angle other than 90 degrees to or parallel to the longitudinal axis. Shape of plant part: Inequilateral; bilaterally asymmetric. Applies to the base, apex, two-dimensional outline, position and attitude in relation to plant parts.
Obloid	Transverse ellipsoid; shorter than broad, broadest at the middle with margins tapering convexly and evenly to the base and apex, the longest dimension orientated transversely. Length/width ratio of the basic shape: 1:1,5 to 1:2. Forms part of the 'ellipsoid' series.
Oblong	Approximately rectangular, with more or less parallel sides terminating obtusely at both ends; four-sided with opposite sides parallel and all angles approximately 90 degrees. Length/width ratio of the basic shape: 2:1 to 1,5. The 'oblong' series also includes 'square' and 'linear', differing only in their length/width ratios, 'square' having the same dimension in both its length and its width.
Oblong	With more or less parallel sides terminating obtusely at the base and apex, circular in transverse section. Length/diameter ratio of the basic shape: 2:1 to 1,5:1. Applies to two- and three-dimensional shape. The 'oblong' series also includes ……

Term	Definition / comment
Obovate	Inversely ovate; broadest above the middle, that is towards the apex. Length/width ratio of the basic shape: 2:1 to 1,5:1. Compare the ‘ovate’ series which is broadest towards the base and ‘obovoid’ which applies to three-dimensional shape.
Obovoid	Inversely ovoid; broadest above the middle, that is towards the apex. Length/width ratio of the basic shape: 2:1 to 1,5:1. Compare the ‘ovoid’ series which is broadest towards the base and ‘obovate’ which applies to two-dimensional shape.
Obtriangular	Inversely triangular; with three more or less straight sides, broadest at the apex and narrowing towards the point of attachment. Length/width ratio of the basic shape: 2:1 to 1,5:1. The ‘obtriangular’ series also includes ‘obdeltate’, with a more specific length/width ratio. Compare ‘triangular’ which is broadest at the base and ‘obconic’ which applies to three-dimensional shape.
Obtrullate	Inversely trullate; broadest above the middle and tapering towards the basal and apical ends, the lateral margins more or less straight but angled at the position of greatest width. Length/width ratio of the basic shape: 2:1 to 1,5:1. Compare the ‘obovate’ series which is less angular, and the ‘rhombic’ series which is broadest at the middle.
Obtuse	With straight to convex margins terminating in a blunt tip at an angle of 90 ° or more. Applies to the apex, base, etc. Compare ‘acute’ where the angle is <90 °. In cases where it is useful to distinguish between ‘narrow obtuse’ and ‘broad obtuse’, one should remember that they should both still be >90 °.
Open	Term used to describe plants with sparse branches or foliage.
Orbicular	use “Circular”
Outwards	a plant part/ plant parts facing outwards in relation to the whole plant or in relation to other relevant plant parts, e.g. the corolla facing outwards in relation to the longitudinal axis of the flower. Compare ‘inwards’.
Ovate	Chicken-egg-shaped; broadest below the middle, that is towards the point of attachment, the margin entirely convex, although the apex may be either rounded or pointed. Length/width ratio of the basic shape: 2:1 to 1,5:1. Compare the ‘obovate’ series which is broadest towards the apex and ‘ovoid’ which applies to three-dimensional shape.
Ovoid	Chicken-egg-shaped; broadest below the middle, that is towards the base, entirely convex, although the apex may be either rounded or pointed. Length/width ratio of the basic shape: 2:1 to 1,5:1. Compare the ‘obovoid’ series which is broadest towards the apex and ‘ovate’ which applies to two-dimensional shape.
Panicle [m]	a definite inflorescence that is increasingly more strongly and irregularly branched from the top to the bottom and where each branching has a terminal flower.
Pannose	Covered by the general term “hair” in the Test Guidelines. Felted; densely covered with short, matted, intertwined hairs.’ Compare ‘tomentose’ which is less matted.

Term	Definition / comment
Papillose	Pimpled, with small, rounded, soft to firm, unequal bumps. Compare ‘bullate’ which has flatter, blister-like convexities.
Papyraceous, Papery	With the consistency of paper; thin and somewhat opaque. Compare ’membranous’ which is more transparent.
Pear-shaped	See ‘pyriform’.
Pedicelled (Pedicellate)	An individual flower or fruit borne on a stalk.
Peltate	Shield-shaped; applies to a stalked plant part, normally circular in shape and with the stalk attached at or near the center of the lower surface.
Pendent	Hanging downwards due to its own weight. Compare ‘pendulous’. Compare ‘drooping’ and ‘weeping’, which are ‘bending downwards’, ‘weeping’ being more pronounced than ‘drooping’.
Pendulous	Hanging downwards, due to the weakness of its support. Compare ‘pendent’.
Perpendicular	At right angle to another plant part.
Pilose	Covered by the general term “hair” in the Test Guidelines. With long, soft, sparse, slender trichomes. Compare ‘villous’ which is more shaggy.
Pointed	A general term for a base or apex which can be ‘acute’ (<90°) or ‘obtuse’(>90°). For the base, the term cuneate may be used instead of ‘pointed’.
Pointed	A general term for a base or apex, etc. with straight or slightly convex margins terminating in a sharp or blunt tip. Compare ‘acute’ (<90°), obtuse (>90°).
Prickly	See ‘aculeate’.
Procumbent	Growing flat on the ground but not rooting at the nodes. Compare ‘stoloniferous’ rooting at the nodes.
Profile	In the UPOV Test Guidelines, the term “shape” should be used in its broadest sense and the use of terms such as “form” and “profile” should be avoided to minimize discrepancies in translation
Prominent	Standing out clearly from the surrounding surface, e.g. veins raised on the abaxial side of a leaf. Compare ‘conspicuous’, which is ‘clearly visible’.
Prostrate	Growing flat on the ground. Compare ‘procumbent’ (not rooting at the nodes) and ‘stoloniferous’ (rooting at the nodes or tips), both more specific types of prostrate. Also compare ‘decumbent’ of which the apical parts ascend.
Proximal	Located at the base, closest to the position of attachment. Compare ‘apical’, ‘distal’, ‘terminal’. Synonyms: Basal, Proximal (most appropriate term to be decided on a case-by-case basis)
Pubescent	The terms ‘pubescent’/’pubescence’ are synonymous with ‘hairy’/’hairiness’ for the purposes of Test Guidelines.
Pungent	Terminating in a long, rigid, sharp point which is both vascular and laminar in nature. Applies to the most distal part of the apex (tip). Compare ‘cuspidate’ where the point is shorter.
Pyriform	Pear-shaped; obovoid with a contraction towards the base.

Term	Definition / comment
Pyrimidal	
Quadrangular	Rectangular; four-sided with opposite sides parallel and all angles approximately 90 degrees. The term ‘oblong’ is preferred for UPOV use.
Raceme m	an unbranched, indeterminate inflorescence with pedicellate (having short floral stalks) flowers along the axis
Racemose corymb m	an unbranched, indeterminate inflorescence that is flat-topped or convex due to their outer pedicels which are progressively longer than inner ones.
Ramified	Branched.
Reclining	With branches gradually curving downwards from an erect position, the distal parts lying on the ground.
Rectangular	use ‘oblong’
Recurved	Curving downwards (abaxially). Compare ‘reflexed’, which is bent downwards more abruptly.
Reflexed	(a) An angle which is >180°; or (b) Bent downwards (abaxially) abruptly. Compare ‘recurved’ of which the downward curving is less abrupt.
Reniform	Kidney-shaped; thickly lunate with rounded ends. Compare ‘lunate’. Synonyms: Reniform, Kidney-shaped (most appropriate term to be decided on a case-by-case basis)
Repand	Shallowly sinuate. Compare ‘undulate’ which is wavy perpendicular to the plane of the plant part.
Resinous	Covered with or exuding resin, which may be sticky. Compare ‘viscid’.
Reticulate	Netted; with a fine network contrasting in color or texture, e.g. veins on the abaxial side of a leaf. Compare ‘rugose’ which has convex areas in between the netted venation.
Retuse	Notched; with an obtuse, shallow, central sinus. Applies to the apex. Compare ‘emarginate’ and ‘obcordate’.
Revolute	With margins rolled towards the abaxial surface. Compare ‘involute’ with margins rolled upwards.
Rhombic	Diamond-shaped; broadening towards the middle and tapering with more or less straight margins to the basal and apical end. Length/width ratio of the basic shape: 2:1 to 1,5:1. Compare ‘trullate’ which is broadest below the middle and ‘obtrullate’ which is broadest above the middle.
Rhomboid	Diamond-shaped; square in transverse section, broadest and angled at the middle, tapering with more or less straight margins to each end. Length/width ratio of the basic shape: 2:1 to 1,5:1.
Rigid	Stiff; not easily bendable.
Rotate	Disc-shaped; with a short tube and spreading, flattened, circular limb or lobes. Usually applies to the corolla. Compare ‘salverform’ which has a long tube.
Rough	Coarse; opposite of ‘even’, ‘fine’ and ‘smooth’.
Rough	Textured; coarse, opposite of.

Term	Definition / comment
Round	use “circular”
Rounded	Curved like the outline of a circle. Applies to the base, apex, lateral sides, etc. but not to be used for describing the general outline of a plane figure.
Rugose	Impressed wrinkled; as in a leaf with convex areas in between the netted venation. Compare ‘corrugated’ and ‘reticulate’.
Sagittate	Arrowhead-shaped; gradually enlarged basally from an acute apex, with two more or less triangular basal lobes directed downward. Applies to the base and overall outline. Compare ‘hastiform’ of which the lobes are directed outwards and ‘hastate’ which applies to the base.
Sagittate	Arrowhead-shaped; with two equal, more or less triangular lobes directed downwards. Applies to the base and overall outline. Compare ‘hastate’ with triangular lobes directed outwards and ‘auriculate’ with rounded lobes directed outwards.
Salverform	Salver-shaped; with a long, narrow tube abruptly expanding to a flattened limb or lobes. Applies to the corolla. Compare ‘rotate’ which has a short tube.
Scabrous	Rough to the touch
Semi-ellipsoid	Ellipsoid with the basal half cut off; rounded at the apex and flattened at the base.
~~Semi-elliptic~~ [f]	~~An ellipse with the basal half cut off; rounded at the apex and flattened at the base.~~
Semi-erect	Standing up at more or less 45 degrees in relation to the ground or to the surface where the plant part is attached. For UPOV purposes ‘semi-erect’ is used for plant parts only (attitude) and not for the whole plant (habit). The term to be used for plant habit is ‘semi-upright’.
Semi-upright	Half-upright; between ‘upright’ and ‘spreading’, not as tall and narrow as ‘upright’ and not as wide as ‘spreading’. For UPOV purposes ‘semi-upright’ is used for the whole plant only (habit) and not for plant parts (attitude). The term to be used for plant parts is ‘semi-erect’.
Semi-shrub	Woody perennial with multiple stems arising generally from the same point but not close to ground level or the graft point, with a main stem, not tall. (see also “tree” and “shrub”)
Sericeous	Silky; with fine, long, adpressed trichomes.
Serrate	With sharp teeth pointed forwards, towards the apex. The front side of a tooth is shorter than the back. Compare ‘crenate’ where the teeth are rounded and ‘dentate’ where the teeth point outwards.
Serrulate	Finely serrated. See “serrate”.
Sessile	Stalkless; attached directly to the supporting plant part. Compare ‘stalked’ and ‘pedicelled’.
Setose, Setaceous	Covered by the general term “hair” in the Test Guidelines. Bristly; with long, erect, sharply pointed, rigid trichomes. Spiny to the touch. Compare ‘hispid’ which is harsh to the touch and ‘strigose’ with adpressed trichomes.
Shape	In the UPOV Test Guidelines, the term “shape” should be used in its broadest sense and the use of terms such as “form” and “profile” should be avoided to minimize discrepancies in translation

Term	Definition / comment
Sheathing	Surrounding a plant part and resembling a tube; e.g. the leaf base of a grass surrounding the stem.
Shrub Shrubby ~~(Shrub)~~	Woody perennial with multiple stems arising from ground level or close to the grafting point, with relatively low height. (see also "tree" and semi-shrub")
Sinuate	Alternatively concave and convex in the plane of the organ; wavy. Compare 'repand' which is shallowly 'sinuate' and 'undulate' which is wavy perpendicular to the plane of the plant part. Comment: When e.g. a leaf is more deeply incised so as not to only affect the margin, it is lobed. This is handled under the section 'Division'. *EB: To check the above comment.* CB 2005: Page 51 2.18 Yes, comment is useful. We must not confuse margin terms with leaf divisions. It is possible to have a crenate margin on the lobe of a divided leaf. As stated the size of the marginal incision is significant and beyond a certain point it is no longer the margin that is divided but the whole leaf. A guide could be if the incision is more than half the distance between the margin and the midrib, then the leaf is divided, not just the margin. We need to discuss this. ASL As I understand – the blade of the leaf is flat but the margin winds strongly inward and outwards EB: I agree. Is the definition OK?ASL As sinuate but the margin winds up and down
Smooth	Even; opposite of rough. For internal texture characteristics the term 'fine' is used.
Spadix [m]	a spike of flowers densely arranged around it, enclosed or accompanied by a highly specialized bract called a spathe. It is characteristic of the *Araceae* family.
Sparse	Few per unit area, as opposed to 'dense'. The term "open" is used to describe plants with sparse branches or foliage.
Spathulate	use 'spatulate'.
Spatulate	Spoon-shaped; attenuate at the base and rounded at the apex. Compare 'clawed' ('unguiculate') which narrows more abruptly towards the base.
Spheric	use 'Globose'
Spike [m]	a type of raceme with flowers that do not have a pedicel
Spine	A rigid, sharply pointed modified organ or part of an organ e.g. a modified stem or reduced branch, leaf, stipule, etc. Contains superficial as well as deeper layers. Compare 'prickle' which arises from the superficial layers only and 'thorn' which can be used synonymously to 'spine' but normally applies to modified stems only. CB 2005: Page 45 2.5 The use of prickle, spine and thorn are often confused and misunderstood. For the Blackberry guideline revision I have concluded the following. Spine: tough, usually woody structure, exogenous, contains vascular tissue and has a sharp point found on the leaf, stem and root. Prickle: a type of small spine found usually on a leaf. A prickle is not in a leaf axil, subtending a bud, lacks vascular tissue and is exogenous. Thorn: a type of spine, usually of larger size, sharp pointed, hard outgrowth from stem wood. Could be added to 2.5 as 2.5.4-.6

Term	Definition / comment
Spinose (Spiny, Thorny)	Bearing spines; with stiff, sharp projections from the superficial and deeper layers of the plant part. Compare ‘aculeate’ (only from the superficial layers).
Spiral	Corkscrew-shaped; the circumference even or diminishing.
Spreading	Directed outwards; e.g. branches diverging. Also applies to growth habit.
Spur Type	Plant habit in which the shoot internodes are very short. Found in some fruit varieties.
Squamose	Scaly; with minute adpressed scales.
Square	Equilaterally quadrangular or rectangular; with the length and the width having the same dimensions. Length/width ratio 1:1. Forms part of the ‘oblong’ series.
Stalked	Attached to the supporting plant by a stalk. Compare ‘sessile’ and ‘pedicelled’.
Stance	use ‘attitude’
Star-shaped	use ‘stellate’
Stellate	Star-shaped: with several points radiating from the center
Stipitate	use ‘stalked’.
Stoloniferous	Bearing prostrate stems rooting at the nodes or at the tips, producing new plants. Compare ‘procumbent’ not rooting at the nodes.
Striate	Finely striped; with more or less parallel lines of a different color, or grooves or ridges. Compare ‘aciculate’ (needle scratches in different directions).
Strigose	Covered by the general term “hair” in the Test Guidelines. With stiff, sharp, coarse, adpressed, bristly trichomes, often swollen at the base. Compare ‘setose’ with erect trichomes.
Subulate	Awl-shaped; tapering from a narrow base to a fine, sharp point.
Symmetric	Being capable of median division into two equal halves, at least along the longitudinal axis. Compare ‘asymmetric’, ‘actinomorphic’.
Sympetalous	With petals fused, at least partly, into a corolla tube. Compare ‘apopetalous’.
Terete	Long and slender, tapering towards the apex, circular in transverse section.
Terminal	Located at the apex and/or furthest from the position of attachment. Compare ‘proximal’, ‘basal’ which is closest to the position of attachment. Synonyms: Apical, Distal, Terminal (most appropriate term to be decided on a case-by-case basis)
Tetrahedronal	

Term	Definition / comment
Thorn	A rigid, sharply pointed modified organ or part of an organ, normally a modified stem. Contains superficial as well as deeper layers. Compare 'prickle' which arises from the superficial layers only and 'spine' which can be used synonymously to 'thorn' but may apply to other modified organs as well, e.g. a leaf or stipule, etc. CB 2005: Page 45 2.5 The use of prickle, spine and thorn are often confused and misunderstood. For the Blackberry guideline revision I have concluded the following. Spine: tough, usually woody structure, exogenous, contains vascular tissue and has a sharp point found on the leaf, stem and root. Prickle: a type of small spine found usually on a leaf. A prickle is not in a leaf axil, subtending a bud, lacks vascular tissue and is exogenous. Thorn: a type of spine, usually of larger size, sharp pointed, hard outgrowth from stem wood. Could be added to 2.5 as 2.5.4-.6
Thorny	See 'spinose'.
Thyrse m	A raceme in which the single flowers are replaced by cymes is called a (indefinite) thyrse. A botryoid in which the single flowers are replaced by cymes is a definite thyrse or thyrsoid. Thyrses are often confusingly called panicles.
Tip	See Part II, Section 2.4
Tomentose	Covered by the general term "hair" in the Test Guidelines. Densely woolly; with short, matted, interwoven trichomes. 'Densely and softly matted-lanate.' Compare 'pannose' which is even denser and more matted (felted) and compare 'lanate' with longer, less matted hairs.
Top	To be used in relation to soil level. Compare 'tip' and 'apex'.
Transverse	Perpendicular to the longitudinal axis, i.e. at right angle to the axis extending through the base and the apex, whether or not this is the longest axis. Compare 'longitudinal'.
Trapezoidal	
Tree	having a main trunk, with branches arising from different points and usually a distinct crown. (see also "shrub" and "semi-shrub")
Triangular	With three more or less straight sides, broadening towards the base, that is towards the point of attachment. Length/width ratio of the basic shape: 2:1 to 1,5:1. The triangular series also includes 'deltate', with a more specific length/width ratio. Compare 'obtriangular' which is broadest towards the apex and 'conic' which applies to three-dimensional shape.
Trichome	Unbranched hair-like outgrowth from the epidermis. ASL add with or without glands? EB: We could add that. ASL My definitions say trichomes are 'any hair like growths, glandular or eglandular from the epidermis' they do not mention branching so one assumes that a branched hair from the epidermis could be called a trichome.

Term	Definition / comment
Trullate	Broadest below the middle and tapering towards the basal and apical end, the lateral margins more or less straight but angled at the position of greatest width. Length/width ratio of the basic shape: 2:1 to 1,5:1. Compare the 'ovate' series which is less angular, and the 'rhombic' series which is broadest at the middle.
Truncate	With the base (apex) abruptly terminated in a straight, transverse, basal (distal) margin, as if cut off. Applies to the base and apex.
Tubular	Hollow, long and narrow with an even diameter, circular in transverse section. Compare 'cylindric', which is solid.
Twining	Climbing by coiling around a support.
Umbel [m]	a type of raceme with a short axis and multiple floral pedicels of equal length that appear to arise from a common point.
Undulate	Wavy perpendicular to the plane of the plant part. Compare 'repand' and 'sinuate' which are wavy in the plane of the plant part.
Unguiculate	use 'clawed'.
Upright	General term used for tall and narrow plants. More specifically, 'fastigiate' may be used if the branches are virtually erect and parallel to the main stem, and 'columnar' if the branch development is suppressed. For UPOV purposes 'upright' is used for the whole plant only (habit) and not for plant parts (attitude). The term to be used for plant parts is 'erect'.
Upwards	Growing or orientated gradually upwards in relation to soil level or to other plant parts.
Urceolate	Pitcher-shaped; with a tube that is very wide at the base, narrowing towards the apex, and strongly constricted at or below the mouth. Applies to the corolla.
Velutinous	Covered by the general term "hair" in the Test Guidelines. Velvety; with long, dense, straight trichomes. Compare 'tomentose' with interwoven trichomes.
Ventral	The upper, inner or adaxial side in relation to the axis. Compare 'dorsal'.
Verrucose	Warty; with more or less irregularly shaped wart-like elevations. Compare 'bullate', where the convexities are blister-like.
Vertical	Upright in relation to the ground. To be used in relation to soil level, i.e. perpendicular to 'horizontal'.
Villous	Covered by the general term "hair" in the Test Guidelines. Shaggy; with long, slender, soft trichomes. Compare 'pilose' which is less shaggy.
Vine	Climbing or trailing plant with long, slender stems, not self-supporting.
Viscid	Sticky or gummy. Compare 'resinous', in which case the stickiness is due to resin.
Wart	See 'verrucose'
Weeping	Bending downwards, the terminal parts hanging. Compare 'drooping' where downward bending is less pronounced.
Wrinkled	With folds or creases; a general term. Compare 'corrugated' and 'rugose' where the wrinkling has a more specific nature.
Zig-zag	With regular, angular, alternating changes of direction.
Zygomorphic	Bilaterally symmetric, only along the longitudinal axis, e.g. flower of Fabaceae. Compare 'actinomorphic'.

~~SUBSECTION 3: COLOR~~ [n]

SECTION 3. STATISTICAL TERMS

The TWC proposed to develop and introductory section to explain that the definitions included in the glossary are in relation to the use of this terms in DUS examination.

[o]**Acceptance probability:** "The minimum probability of accepting a variety with the population standard of off-types. (See document TGP/8: Part II, Section [4.1])"

Additivity: Effects, for example in an analysis of variance, are said to be additive if there is no interaction between them.

Alpha (α): Statisticians use the Greek letter alpha to indicate the probability of rejecting the statistical hypothesis tested when in fact, that hypothesis is true. α is called the significance level of a test. Before conducting any statistical test, it is important to set a value for alpha. For establishing distinctness, alpha is sometimes set at 0.01. This is the equivalent of asserting that one will reject the hypothesis tested 1 out of 100 times if the obtained test statistic is among those that would occur from random samples drawn from a population in which the hypothesis is true. If the obtained statistic leads to rejection of the tested hypothesis, it is not because the obtained statistic could not have occurred by chance, ~~but because the odds of obtaining the statistic by chance are sufficiently low (one out of hundred), and so it is reasonable to conclude that the results are not due to chance.~~ but because the probability of obtaining the statistic by chance is sufficiently low (1 in 100), and so it is reasonable to conclude that the results are not due to chance.[o]

Alpha-design: Alpha designs are a very flexible class of resolvable incomplete block designs. Such designs are particularly useful when there are many treatments to be examined, the variability of the experimental units is such that the block size needs to be kept small, and blocks can be combined into ~~full~~ complete [o] replicates.

Alternative Hypothesis: In hypothesis testing, the null hypothesis and an alternative hypothesis are put forward. If the data support sufficiently strongly rejection of the null hypothesis, then the null hypothesis is rejected in favor of an alternative hypothesis. For instance, if the null hypothesis were that $\mu_1 = \mu_2$ then the alternative hypotheses would be $\mu_1 \neq \mu_2$ (two-sided), or $\mu_1 < \mu_2$ or $\mu_1 > \mu_2$ (one-sided).

ANOVA: This term is an acronym for a procedure entitled Analysis of Variance. This procedure employs the statistic (F) to test the statistical significance of the differences among the obtained means of two or more random samples from a given population. When there are one or two factors in the experiment, the analysis is called a one-way or a two-way analysis of variance respectively. See also factorial design.

Assumptions: see model assumptions

(Balanced) Complete Block Design / Randomized complete block design : An experimental lay-out where all treatments are present once in every block. Blocking is done to make the experimental units more homogeneous within each group. All treatments are randomly assigned within each block to minimize the confounding effect of the heterogeneous experimental units. This is a common design for field trials of agricultural crops.

Balanced Incomplete Block Design: This differs from a balanced complete block design in that the block size is less than the total number of treatments. Each treatment is replicated equally and the assignment of the treatments over the blocks is such that the SED of each pair of treatment means has the same value.

Bar graph: A bar graph is much like a histogram, differing in that the columns are separated from each other by a small distance. Bar graphs are commonly used for qualitative variables.

Beta (β): Statisticians use the Greek letter beta to indicate the probability of failing to reject the null hypothesis when it is false and a specific alternative hypothesis is true. For a given test, the value of beta is determined by the value of alpha, features of the statistic that is being calculated (particularly the sample size) and the specific alternative hypothesis that is being entertained. While it is possible to carry out a statistical test without defining a specific alternative hypothesis, neither beta nor power can be calculated. It is relevant to note here that power (the probability that the test will reject the hypothesis tested when a specific alternative hypothesis is true) is equal to one minus beta (i.e. power = 1 - beta). See Power

Between plot standard deviation: When speaking about variance components this term is commonly used for the variability between experimental units, like plots.

Bias: Bias is the difference between the true value of the parameter and the expected value of the estimator. An estimator is biased if the expected value of the estimator doesn't equal the parameter it is estimating.

Binomial Distribution: When a coin is flipped, the outcome is either a head or a tail. In this example, the event has two mutually exclusive possible outcomes. For convenience, one of the outcomes can be labeled "success" and the other outcome "failure." If an event occurs N times (for example, a coin is flipped N times), then the binomial distribution can be used to determine the probability of obtaining exactly r successes in the N outcomes. The binomial probability for obtaining r successes in N trials is:

$$P(r) = \binom{N}{r} \pi^{r} (1-\pi)^{N-r}, \qquad r = 0,1\ldots N$$

where P(r) is the probability of exactly r successes, N is the number of events, and π is the probability of success on any one trial. This formula assumes that the events:

(a) are dichotomous (fall into only two categories)
(b) are mutually exclusive
(c) are independent and
(d) are randomly selected

Bivariate Normality: A particular form of distribution of two variables that has the traditional 'bell' shape (but not all bell-shaped distributions are normal). If plotted in three-dimensional space, with the vertical axis showing the number of cases, the shape would be that of a three-dimensional bell (if the variances on both variables were equal) or a flattened three-dimensional bell (if the variances were unequal). When perfect bivariate normality obtains, the distribution of one variable is normal for each and every value of the other variable. See also Normal Distribution.

[Note: to add 3 dimensional graphic of bivariate distribution]

Blocking: A method in the design of experiments used to reduce the variability of residuals. Types of designs that use this method are generally called block designs. A great number of types exist but only a few one are considered in this document. See also Block Design.

Block Design: see Balanced Complete Block Design, (Balanced) Incomplete Block Design, Randomized Complete Block Design, Alpha Design.

Box plot – also called box-and-whisker diagram: A schematic plot to display the distribution of a variable. The box spans the interquartile range of the values in the variable, so that the middle 50% of the data lie within the box, with a line indicating the median. Whiskers can extend beyond the ends of the box as far as the minimum and maximum values.

° **Categorical variables:** see Variables

Central Limit Theorem: The Central Limit Theorem is a statement about the characteristics of the sampling distribution of means of random samples from a given population. That is, it describes the characteristics of the distribution of values we would obtain if we were able to draw an infinite number of random samples of a given size from a given population and we calculated the mean of each sample.

The Central Limit Theorem consists of three statements:

1. The mean of the sampling distribution of means is equal to the mean of the population from which the samples were drawn.

2. The variance of the sampling distribution of means is equal to the variance of the population from which the samples were drawn divided by the size of the samples.

3. If the original population is distributed normally (i.e. it is bell shaped), the sampling distribution of means will also be normal. If the original population is not normally distributed, the sampling distribution of means will increasingly approximate a normal distribution as sample size increases. (i.e. when increasingly large samples are drawn)

Chi-Square: The statistic X^2 (Chi-Square) is what statisticians call an enumeration statistic. Rather than measuring the value of each of a set of items, a calculated value of Chi-Square compares the frequencies of various kinds (or categories) of items in a random sample to the frequencies that are expected if the population frequencies are as hypothesized by the investigator. Chi-square is often used to assess the “goodness of fit” between an obtained set of frequencies in a random sample and what is expected under a given statistical hypothesis. For example, Chi-Square can be used to determine if there is reason to reject the statistical hypothesis that the frequencies in a random sample are as expected when the items are from a normal distribution.

Chi-squared (χ^2) distribution: distribution of the sum of squared independent standard normal variables. Used to do significance tests on chi-squared statistics.

Coefficient: A coefficient is a constant used to multiply another value. In the linear transformation Y = 3X + 7, the coefficient “3” is multiplied by the variable X. In the linear combination of means $L = (2)M_1 + (-1)M_2 + (-1)M_3$ the three numbers in parentheses are coefficients.

Completely Randomised Design: An experimental lay-out where the experimental units are homogenous and the treatments are randomly assigned to the uniform experimental units without any constraint. It is the simplest experimental design, which is used in the testing of many horticultural and ornamental crops under greenhouse condition where the experimenter has more control over the experimental units.

Confidence Interval: A confidence interval is a range of values that has a specified probability of containing the parameter being estimated. The 95% and 99% confidence intervals, which have 0.95 and 0.99 probabilities of containing the parameter respectively are most commonly used. If the parameter being estimated were μ, the 95% confidence interval might look like the following:

$$12.5 \leq \mu \leq 30.2$$

What this means is that the interval between 12.5 and 30.2 has a 0.95 probability of containing μ.

Confounding: Two factors are confounded if they vary together in such a way that it is impossible to determine which factor is responsible for an observed effect. For example, consider an experiment in which two fungicides treatments for foliar disease control were compared. Treatment one was given to the one variety and treatment two was given to another variety. If a difference between treatments were found, it would be impossible to tell if one treatment were more effective than the other or if treatments for disease control are more effective for one variety than the other. In this case, varieties and treatment are confounded. Sometimes, confounding is much more subtle. An experimenter may accidentally manipulate a factor in addition to the factor of interest.

Consistency: An estimator is consistent if the estimator tends to get closer to the parameter it is estimating as the sample size increases.

Contingency Table: A contingency table is a table showing the responses of subjects to one factor as a function of another factor. For instance, the following contingency table shows disease resistance as a function of different varieties (the data are hypothetical). The entries show the number of plants for each variety under different level of disease resistance. The Chi-square test of independence is used to test the relationship between rows (varieties) and columns (disease resistance) for significance.

~~*Disease Resistance*~~	~~Resistant~~	~~Moderately Resistant~~	~~Susceptible~~
~~*Variety*~~			
~~Candidate~~	~~18~~	~~20~~	~~2~~
~~Comparator 1~~	~~3~~	~~10~~	~~27~~
~~Comparator 2~~	~~6~~	~~24~~	~~10~~

[Note: Australia to provide new example]

Continuous Variable: A continuous variable is one for which, within the limits the variable's range, any value is possible. For example, the variable 'plant height' is continuous since it may be 1.21m, 1.25m or even 1.30m etc to measure plant heights. The variable 'Number of lobed leaves' is not a continuous variable since it is not possible to get 54.12 lobed leaves from 100 leaves counted. It must be an integer. See also 'discrete variable'

Correlation (Pearson): Given a pair of related measures (X and Y) on each of a set of items, the correlation coefficient (r) provides an index of the degree to which the paired measures co-vary in a linear fashion. In general r will be positive when items with large values of X also tend to have large values of Y whereas items with small values of X tend to have small values of Y. Correspondingly, r will be negative when items with large values of X tend to have small values of Y whereas items with small values of X tend to have large values of Y. Numerically, r can assume any value between -1 and +1 depending upon the degree of the relationship. Plus and minus one indicate perfect positive and negative relationships whereas zero indicates that the X and Y values do not co-vary in any linear fashion. See Measures of association.

COYD: Abbreviation of Combined-Over-Years Distinctness criterion. Statistical method to test distinctness in DUS testing. See TGP/9

COYU: Abbreviation of Combined-Over-Years Uniformity criterion. Statistical method to test uniformity in DUS testing. See TGP/10

Critical Value: A critical value (which depends on the level of significance, alpha) is used in significance testing. It is the value that a test statistic must exceed in order for the null hypothesis to be rejected. For example, the critical value of t (with 12 degrees of freedom in a two-sided test using the alpha=0.05 significance level) is 2.18. This means that for the probability to be less than or equal to 0.05, the absolute value of the t statistic must be 2.18 or greater.

Degrees of Freedom: Statisticians use the terms 'degrees of freedom' to describe the number of values in the final calculation of a statistic that are free to vary. Consider, for example the statistic s^2, the estimated variance of a sample. To calculate the estimated variance of a random sample, we must first calculate the mean of that sample and then compute the sum of the several squared deviations from that mean. While there will be n such squared deviations only (n - 1) of them are, in fact, free to assume any value whatsoever. This is because the final squared deviation from the mean must include the one value of X such that the sum of all the Xs divided by n will equal the obtained mean of the sample. All of the other (n - 1) squared deviations from the mean can, theoretically, have any values whatsoever. For these reasons, the statistic s^2, the estimated variance of a sample, is said to have only (n - 1) degrees of freedom.

Dependent Variable: A variable which the analyst is trying to explain in terms of one or more independent variables. The distinction between dependent and independent variables is typically made on theoretical grounds-in terms of a particular causal model or to test a particular hypothesis. This is often called the Y-variable.

Design of experiment: see Experimental design

Discrete Variable: A discrete variable is one that cannot take on all values within the limits of the variable. For example, responses to a five-point rating scale can only take on the values 1, 2, 3, 4, and 5. The variable cannot have the value 1.7. A variable such as a plant height can take on any value. Variables that can take on any value and therefore are not discrete are called continuous. Statistics computed from discrete variables can be continuous. The mean on a five-point scale could be 3.117 even though 3.117 is not possible for an individual score.

Dispersion: Synonyms are variation, variability or spread. A variable's dispersion is the degree to which scores on the variable differ from each other. If every score on the variable were about equal, the variable would have very little dispersion. There are many measures of dispersion, eg. variance, standard deviation, range, interquartile range etc.

o **Distribution** **(Probability Distribution):** Form of a function that describes the possible outcomes of a variable. ~~The (probability) distribution of a (random) variable specifies the chance that the variable takes a value in any subset of the real numbers. See Binomial Distribution, Chi-squared distribution, Continuous Distribution, Discrete Distribution, F-Distribution, Frequency Distribution, Normal Distribution, Relative Frequency Distribution, Standard Normal Distribution, Symmetric Distribution, Student's t-Distribution, t-Distribution, Z-Distribution.~~ The distribution of a variable specifies the chance that the variable takes a value in any subset of the real numbers. Examples include [Binomial Distribution, Chi-squared distribution, Continuous Distribution, Discrete Distribution, F-Distribution, Frequency Distribution, Normal Distribution, Relative Frequency Distribution, Standard Normal Distribution, Symmetric Distribution, Student's t-Distribution, t-Distribution, Z-Distribution etc.] p

Effect: see Main Effect

Efficiency: The efficiency of a statistic is the degree to which the statistic is stable from sample to sample. That is, the less subject to sampling fluctuation a statistic is, the more efficient it is. The efficiency of a statistic is measured relative to the efficiency of other statistics and is therefore often called the relative efficiency. If statistic A has a smaller standard error than statistic B, then statistic A is more efficient than statistic B. The relative efficiency of two statistics may depend on the distribution involved. For instance, the mean is more efficient than the median for normal distributions but not for many types of skewed distributions. The efficiency of a statistic can also be thought of as the precision of the estimate: the more efficient the statistic, the more precise the statistic is as an estimator of the parameter.

Estimation: The process of using a statistic to estimate a parameter of a distribution.

Estimator: An estimator is used to estimate a parameter. Normally a statistic is used as an estimator. Three important characteristics of estimators are: bias, consistency, and relative efficiency.

Expected Value: A theoretical average value of a statistic over an infinite number of samples from the same population.

Experimental Design: The lay-out of an experiment. See Completely Randomised Design, Balanced Complete Block Design, Incomplete Block Design, Alpha Design, Factorial Design.

Experimental Unit: **An experimental unit is the smallest subdivision of the experiment (trial) to which the varieties are randomized. If there are more than one plant within a plot, the observations of a certain characteristic on each plant are used for estimating the plant-to-plant variability of the variety. The mean (or other function) of the observations can be considered as the plot measurement for that characteristic. Usually the experimental unit in a field trial is a plot.**

F Distribution: The F distribution is the distribution of the ratio of two chi-squared variables, e.g. ratio of two estimates of variance. It is used to compute probability values in the analysis of variance. The F distribution has two parameters: degrees of freedom numerator (dfn) and degrees of freedom denominator (dfd). The dfn is the number of degrees of freedom of the numerator, and dfd is the number of degrees of freedom of the denominator. The dfd is often called the degrees of freedom for error or dfe. In the simplest case of a one-factor between-subjects ANOVA,

dfn = a-1

dfd = N-a

where "a" is the number of groups and "N" is the total number of subjects in the experiment. The shape of the F distribution depends on dfn and dfd. The lower the degrees of freedom, the larger the value of F needed to be significant. For instance, if dfn = 4 and dfd = 12, then an F of 3.26 would be needed to be significant at the 0.05 level. If the dfn were 10 and the dfd were 100, then an F of 1.93 would suffice.

Factor: Each basic treatment will be called a factor. If an experiment is testing the effect of fertiliser dosage, then 'fertiliser' is a factor. Some experiments have more than one factor. For example, if the effect of fertiliser dosage and irrigation water were both manipulated in the same experiment, then these two variables would be factors. The experiment would then be called a two-factor experiment.

Factor Level: The possible forms of a factor are called the levels of that factor. The levels of factor 'variety' for example are the different varieties in an experiment.

Factorial Design: When an experimenter is interested in the effects of two or more factors, it is usually more efficient to combine these factors in one experiment than to run a separate experiment for each factor. Moreover, only in experiments with more than one factor is it possible to test for interactions between factors. Consider a hypothetical experiment on the effects of the factor nitrogen on grain yield in a cereal crop. There were three levels of nitrogen dosage: 50kg, 100kg and 150kg per hectare. A second factor, water level, was also manipulated. There were two levels of irrigation water on the field: 5cm and 10cm. The grain yield data (t/ha) for each condition (often called treatment) in the experiment is shown below:

Water	5cm	10cm
Dosage		
50 kg/ha	1.5	1.8
100 kg/ha	2.5	2.2
150 kg/ha	2.8	1.9

The number of combinations (six) is therefore the product of the number of levels of dosage (three) and levels of water (two). Also see: Main Effect.

° **Fisher's Exact Test:** a statistical test used for assessing significance in categorical data (see document TGP/8: Part II, Section [3.7])

Fitted Values of dependent variable: Explained part of observed values of the dependent variable. These values are calculated by using the estimated parameters in a model.

Fitted Constants: Special type of an (non-orthogonal) analysis of variance model assuming additivity of the factors.

Fixed term/Fixed factor: A factor is fixed when the levels under study are the only levels of interest. The levels of the factor are said to have fixed effects. For example, the treatments applied to field trials of agricultural crops are usually a fixed factor. See also factor. [q]

F Ratio: Ratio (quotient) of two variances that is F-distributed. It is used for example in ANOVA's to test the effect of factors and their interactions.

Frequency Distribution: A frequency distribution shows the number of observations falling into each of several intervals of values. Frequency distributions are portrayed as frequency tables, histograms, or polygons. Frequency distributions can show either the actual number of observations falling in each interval or the percentage of observations. In the latter instance, the distribution is called a relative frequency distribution.

Frequency Table: A frequency table is constructed by allocating the scores on a variable into intervals and counting the number of scores in each interval. The actual number of scores is displayed as well as the percentage of scores in each interval.

Heteroscedasticity: The absence of homogeneity of variance. See Homogeneity of Variance

Heterogeneity: The absence of homogeneity of variance. See Homogeneity of Variance

Hierarchical Analysis: In the context of multidimensional contingency table analysis, a hierarchical analysis is one in which inclusion of a higher order interaction term implies the inclusion of all lower order terms. For example, if the interaction of two factors is included in an explanatory model, then the main effects for both of those factors are also included in the model.

Histogram: A histogram is constructed from a frequency table. The intervals are shown on the X-axis and the number of scores in each interval is represented by the area of a rectangle located above the interval, which, if the intervals are of equal width, is equivalent to the rectangle's height.

Homogeneity of Variance: The assumption of homogeneity of variance (or homoscedasticity of variance) is that the variance within each of the populations is equal. This is an assumption of analysis of variance (ANOVA). ANOVA works well even when this assumption is violated except in the case where there are unequal numbers of subjects in the various groups. If the variances are not homogeneous, they are said to be heterogeneous or heteroscedastic.

Homoscedasticity: See Homogeneity of Variance

Hypothesis Testing: Hypothesis testing is a method of inferential statistics. An experimenter starts with a hypothesis about a population parameter called the null hypothesis. Data are then collected and the viability of the null hypothesis is determined in light of the data. If the data are very different from what would be expected under the assumption that the null hypothesis is true, then the null hypothesis is rejected. If the data are not greatly at variance with what would be expected under the assumption that the null hypothesis is true, then the null hypothesis is not rejected. Failure to reject the null hypothesis is not the same thing as accepting the null hypothesis.

Incomplete Block Design: Block design where the number of plots within each block is smaller than the number of treatments.

Independence: Observations on one plot are called independent if they are not influenced by varieties on other plots. For example if tall varieties are planted next to a small one there could be a negative influence of the big ones on the small one. In such a case a row of plants on both sides of the plot can be planted in order to avoid dependency. See also Statistical Independence.

Independent Variable: Two variables are independent if knowledge of the value of one variable provides no information about the value of another variable. For example, if you measured the terminal leaf length and the degree of fragrance in a rose variety, then these two variables would in all likelihood be independent. Knowing that leaf length would not effect the fragrance of rose. However, if the variables were leaf length and leaf width, then there may be a high degree of dependence. When two variables are independent then the correlation between them is 0.

Interaction: A situation in which the direction and/or magnitude of the relationship between two factors depends on (i.e., differs according to) the value of one or more other factors. When interaction is present, simple additive techniques are inappropriate; hence, interaction is sometimes thought of as the absence of additivity. Synonyms: non-additivity, conditioning effect, moderating effect, contingency effect.

Interquartile Range: The interquartile range is a measure of spread or dispersion. It is computed as the difference between the 75th percentile [often called (Q3)] and the 25th percentile (Q1). The formula for interquartile range is therefore: Q3-Q1. Since half the scores in a distribution lie between Q3 and Q1, the interquartile range is the distance needed to cover 1/2 the scores. The interquartile range is little affected by extreme scores, so it is a good measure of spread for skewed distributions. However, it is more subject to sampling fluctuation in normal distributions than is the standard deviation and therefore not often used for data that are approximately normally distributed.

Interval Scale: A scale consisting of equal-sized units. On an interval scale the distance between any two positions is of known size. Results from analytic techniques appropriate for interval scales will be affected by any non-linear transformation of the scale values. See also Scale of Measurement

Intervening Variable: A variable which is postulated to be a predictor of one or more dependent variables, and simultaneously predicted by one or more independent variables. Synonym: mediating variable.

Kurtosis: Kurtosis indicates the extent to which a distribution is more peaked or flat-topped than a normal distribution.

Least Significant Difference (LSD): A commonly used mean separation procedure. For example, the difference between two means (based on the same number of observations) is declared significant at any desired level of significance if it exceed the value derived from the following formula:

$LSD = t\sqrt{(2S^2/n)}$,

where t is the tabulated two-tailed t-value at the required probability and degrees freedom. S is the pooled standard deviation of the observations and n is the number of observations per mean.

Level of a factor: See Factor Level

Level of significance: See Significance Level

Linear: The form of a relationship among variables such that when any two variables are plotted, a straight line results. A relationship is linear if the effect on a dependent variable of a change of one unit in an independent variable is the same for all possible such changes.

Linear Regression: Linear regression is the prediction of one variable from another variable when the relationship between the variables is assumed to be linear (Y=aX+b).

Linear Transformation: A linear transformation of a variable involves multiplying each value of the variable by one number and then adding a second number. For example, consider the variable X with the following three values: 2, 3, and 7. One linear transformation of the variable would be to multiply each value by 2 and then to add 5. If the transformed variable is called Y, then Y = 2X+5. The values of Y are: 9, 11 and 19.

LSD: See Least Significant Difference

Main Effect: The main effect of a factor is the effect of the factor averaging over all levels of other factors in the experiment. The main effect of irrigation water given in Factorial Design example could be assessed by computing the mean for the two levels of water averaging across all three levels of nitrogen dosage. The mean for the 5cm water is: (1.5 + 2.5 + 2.8)/3 = 2.27 and the mean for the 10cm water is: (1.8 + 2.2 + 1.9)/3 = 1.97. The main effect of water, therefore, involves a comparison of the mean of the 5cm water (2.27) with the mean of the 10cm water (1.97). Analysis of variance provides a significance test for the main effect of each factor in the design.

Mean: The arithmetic mean is what is commonly called the average. When the word "mean" is used without a modifier, it can be assumed that it refers to the arithmetic mean. The mean is the sum of all the scores divided by the number of scores. The formula in summation notation is: $\mu = \sum X/N$, where μ is the population mean and N is the number of scores. If the scores are from a sample, then the symbol M refers to the mean and N refers to the sample size. The formula for M is the same as the formula for μ. The mean is a good measure of central tendency for roughly symmetric distributions but can be misleading in skewed distributions since it can be greatly influenced by extreme scores. Therefore, other statistics such as the median may be more informative for distributions such as reaction time or family income that are frequently very skewed. The sum of squared deviations of scores from their mean is lower than their squared deviations from any other number. For normal distributions, the mean is the most efficient and therefore the least subject to sample fluctuations of all measures of central tendency.

Mean Square Error: The mean square error (MSE) is an estimate of the population variance in the analysis of variance. The mean square error is the denominator of the F ratio.

Measure of Association: A number (a statistic) whose magnitude indicates the degree of correspondence i.e. strength of relationship between two variables. An example is the Pearson product-moment correlation coefficient. Measures of association are different from statistical tests of association (e.g. Pearson chi-square, F-test) whose primary purpose is to assess the probability that the strength of a relationship is different from some pre-selected value (usually zero). See also Statistical Measure, Statistical Test

Median: The median is the middle of a distribution: half the scores are above the median and half are below the median. The median is less sensitive to extreme scores than the mean and this makes it a better measure than the mean for highly skewed distributions.

Missing Data: Information that is not available for a particular case for which at least some other information is available.

Mixed model: A mixed model contains both fixed factors and random factors. The fixed factors might represent treatments, and the random factors might represent blocks, or rows and columns of a field experiment. See also fixed factor and random factor. A mixed model is as opposed to a fixed model or a random model, which are, respectively, models that contains only fixed factors and only random factors. [q]

[o]~~[**Mode:** The mode is the most frequently occurring score in a distribution and is used as a measure of central tendency. The advantage of the mode as a measure of central tendency is that its meaning is obvious. Further, it is the only measure of central tendency that can be used with nominal data. The mode is greatly subject to sample fluctuations and is therefore not recommended to be used as the only measure of central tendency. A further disadvantage of the mode is that many distributions have more than one mode. These distributions are called "multimodal." In a normal distribution, the mean, median, and mode are identical.]~~

~~[Note: to reconsider whether the term "Mode" should be in the glossary]~~

Model: see statistical model

Model assumptions: With all statistical models assumptions are assumed. For example, with ANOVA two assumptions are: the residuals are normally distributed and have homogeneity of variance.

Modified Joint Regression Analysis: A statistical method used to adjust for when marked differences between years in the range of expression of a characteristic can occur. For example, in a late spring, the heading dates of grass varieties can converge. The method involves fitting a model to the variety-by-year table of means for the characteristic such that the model allows for a proportionately larger or smaller variety response depending on the year the data was observed in. For greater detail see TGP/8

Multiple Comparison Test: See Range Test

Multivariate Normality: The form of a distribution involving more than two variables in which the distribution of one variable is normal for each and every combination of categories of all other variables. See also Normal Distribution

Mutually Exclusive Events: Two events are mutually exclusive if it is not possible for both of them to occur at once. For example, if a dice is rolled, the event "getting a 1" and the event "getting a 2" are mutually exclusive since it is not possible for the dice to be both a one and a two on the same roll. The occurrence of one event "excludes" the possibility of the other event.

Nominal Scale: A classification of cases which defines their equivalence and non-equivalence, but implies no quantitative relationships or ordering among them. Analytic techniques appropriate for nominally scaled variables are not affected by any one-to-one transformation of the numbers assigned to the classes. See also Scale of Measurement

Non-additive: Not additive. See Interaction

Normal Distribution: A particular form for the distribution of a variable which, when plotted, produces a 'bell' shaped curve- symmetrical, rising smoothly from a small number of cases at both extremes to a large number of cases in the middle. Not all symmetrical bell-shaped distributions meet the definition of normality.

Normality: See Normal Distribution

Normal Probability Plot: Gives a visual indication of whether the distribution of a set of data is approximately normal. The data are ranked and the percentile of each data value is obtained. The data value is then plotted against the normal equivalent deviate of the data value's percentile. If the distribution is close to normal, the plotted points will lie close to a straight line.

Null Hypothesis: The null hypothesis is an hypothesis about a population parameter. The purpose of hypothesis testing is to test the viability of the null hypothesis in the light of experimental data. Depending on the data, the null hypothesis either will or will not be rejected as a viable possibility. Consider a researcher interested in whether the Variety 1 is taller than Variety 2. The null hypothesis is that $\mu_1 - \mu_2 = 0$ where μ_1 is the mean height of Variety 1 and μ_2 is the mean height of Variety 2. Thus, the null hypothesis concerns the parameter $\mu_1 - \mu_2$ and the null hypothesis is that the parameter equals zero. The null hypothesis is often the reverse of what the experimenter actually believes; it is put forward to allow the data to contradict it. In the experiment, the experimenter probably expects that Variety 1 is taller than Variety 2. If the experimental data show that Variety 1 has a sufficiently higher plant height, then the null hypothesis that there is no difference in plant height can be rejected.

Ordinal Scale: A classification of cases into a set of ordered classes such that each case is considered equal to, greater than, or less than every other case. Analytic techniques appropriate for ordinally scaled variables are not affected by any monotonic transformation of the numbers assigned to the classes. See also Scale of Measurement

Outlier: See Outlying Case

Outlying Case (Outlier): A case whose score on a variable deviates substantially from the mean (or other measure of central tendency). Such cases can have disproportionately strong effects on statistics.

° ~~**Paired t-Test:**~~

Parameter: A parameter is a numerical quantity measuring some aspect of a population of scores. For example, the mean is a measure of central tendency. Greek letters are used to designate parameters. Following are some examples of parameters of great importance in statistical analyses and the Greek symbol that represents each one. Parameters are rarely known and are usually estimated by statistics computed in samples. To the right of each Greek symbol is the symbol for the associated statistic used to estimate it from a sample.

Quantity	*Parameter*	*Statistic*
Mean	μ	M
Standard deviation	σ	S
Proportion	π	P
Correlation	ρ	R

Pattern Variable: A nominally scaled variable whose categories identify particular combinations (patterns) of scores on two or more other variables.

Pooled Standard Deviation: Square root of pooled variance

Pooled Variance: Weighted average of a number of variances.

Population: A population consists of an entire set of objects, observations, or scores that have something in common. The distribution of a population can be described by several parameters such as the mean and standard deviation. Estimates of these parameters taken from a sample are called statistics.

Population standard: The maximum percentage of off-types that would be permitted if all individuals of the variety could be examined. (See document TGP/8: Part II, Section 4.1)[o]

Power: Power is the probability of correctly rejecting a false null hypothesis. Power is therefore defined as: 1 - β where β is the Type II error probability. If the power of an experiment is low, then there is a good chance that the experiment will be inconclusive. That is why it is so important to consider power in the design of experiments. There are methods for estimating the power of an experiment before the experiment is conducted. If the power is too low, then the experiment can be redesigned by changing one of the factors that determine power.

Precision: also called reproducibility or repeatability, is a term applied to the likely spread of estimates of a parameter in a statistical model. Thus it expresses the extent to which further estimates will show the same or similar results. It is measured by the standard error of the estimator. [q]

Predicted Values: see prediction [q]

Prediction: For a given set of values for the explanatory variables of a model, the prediction, or predicted value, is the value of the response variable that is predicted by a statistical model. See also statistical model.[q]

Probability Value: In hypothesis testing, the probability value is the probability of obtaining a statistic as different from or more different from the parameter specified in the null hypothesis as the statistic obtained in the experiment. The probability value is computed assuming the null hypothesis is true. If the probability value is below the significance level then the null hypothesis is rejected. The probability value is also known as the significance probability.

P-Value: See Probability Value

Qualitative Variable: see Variable

Quantitative Variable: see Variable

[Random effect:[r]]

Random Sampling: In random sampling, each item or element of the population has an equal chance of being chosen at each draw. A sample is random if the method for obtaining the sample meets the criterion of randomness (each element having an equal chance at each draw). The actual composition of the sample itself does not determine whether or not it was a random sample.

Random Term / Random Factor: ~~see Mixed models~~ A factor is random when the levels under study can be considered a random sample drawn from some large homogeneous population. A goal of the study may be to make a statement regarding the larger population. The levels of the factor are said to have random effects. See also factor.[s]

[o] ~~**Random Variable:**~~

Randomized complete block design: See (Balanced) complete block design

Randomisation: In designing an experiment to compare a number of varieties with each other it is important to randomize the varieties over the plots.

Range: The range is the simplest measure of spread or dispersion. It is equal to the difference between the largest and the smallest values. The range can be a useful measure of spread because it is so easily understood. However, it is very sensitive to extreme scores since it is based on only two values. The range should almost never be used as the only measure of spread, but can be informative if used as a supplement to other measures of spread such as the standard deviation or semi-interquartile range; e.g. the range of the numbers 1, 2, 4, 6, 12, 15, 19, 26 is 25 (=26 – 1).

Range Test: Range tests are used to compare each mean in an experiment with every other mean; they are based on the studentized range distribution. The most commonly used range tests are: Duncan’s Multiple range Test, Student-Newman-Keul’s Test, Tukey’s Test.

Ranks: The expression of a particular characteristic (e.g., plant height) relative to other cases on a defined scale-as in ‘Short,’ ‘Medium,’ ‘Tall’ etc. Note that when the actual values of the numbers designating the relative positions (the ranks) are used in analysis they are being treated as an interval scale, not an ordinal scale. See also Interval Scale, Ordinal Scale

Ratio Scale: Ratio scales are like interval scales except they have true zero points. A good example is the Kelvin scale of temperature. This scale has an absolute zero. Thus, a temperature of 300 Kelvin is twice as high as a temperature of 150 Kelvin.

Regression Line: A regression line is a line drawn through a scatter-plot of two variables, one is the independent variable (Y) and the other is the dependent variable. The line is chosen so that it comes as close to the points as possible. In linear regression, Y values are obtained from several populations, each population being determined by a corresponding X value. The randomness of Y is essential and it is assumed that the Y populations are normally distributed and have a common variance.

Relative Frequency Distribution: See Frequency Distribution

REML: Restricted Maximum Likelihood method used to analyse a non-orthogonal ANOVA with more than one type of experimental unit.

Residual: Unexplained part of an observation. Remains after fitting a model. It is the difference of the observation and the prediction from the model.

Replication: In order to know whether a difference between a new variety and another variety exists, replicates are needed of the varieties. This is in order to know whether the difference is a real difference between the varieties or a difference due to random fluctuations.

Resolvable Design: A resolvable design is one in which each block contains only a selection of the treatments, but the blocks can be grouped together into subsets in which each treatment is replicated once. The groupings of blocks thus form replicates.

Sample: A sample is a subset of a population. Since it is usually impractical to test every member of a population, a sample from the population is typically the best approach available. Inferential statistics generally require that sampling be random although some types of sampling seek to make the sample as representative of the population as possible by choosing the sample to resemble the population on the most important characteristics.

Sample Size: The sample size is very simply the size of the sample. If there is only one sample, the letter "N" is often used to designate the sample size. If samples are taken from each of "a" populations, then the small letter "n" is often used to designate size of the sample from each population. When there are samples from more than one population, N is used to indicate the total number of subjects sampled and is equal to (a)*(n). If the sample sizes from the various populations are different, then n_1 would indicate the sample size from the first population, n_2 from the second, etc. The total number of subjects sampled would still be indicated by N. When correlations are computed, the sample size (N) refers to the number of subjects and thus the number of pairs of scores rather than to the total number of scores. The symbol N also refers to the number of subjects in the formulas for testing differences between dependent means. Again, it is the number of subjects, not the number of scores.

Sampling Fluctuation: Sampling fluctuation refers to the extent to which a statistic takes on different values with different samples. That is, it refers to how much the statistic's value fluctuates from sample to sample. A statistic whose value fluctuates greatly from sample to sample is highly subject to sampling fluctuation.

Scale of Measurement: Scale of measurement refers to the nature of the assumptions one makes about the properties of a variable; in particular, whether that variable meets the definition of nominal, ordinal, interval or ratio measurement. See also Nominal Scale, Ordinal Scale, Interval Scale, Ratio Scale

SED: Abbreviation of Standard Error of Difference of two means.

SEM: Abbreviation of Standard Error of Mean. See Standard Error of Mean

Semi-Interquartile Range: The semi-interquartile range is a measure of spread or dispersion. It is computed as one half the difference between the 75th percentile [often called (Q3)] and the 25th percentile (Q1). The formula for semi-interquartile range is therefore: (Q3-Q1)/2. Since half the scores in a distribution lie between Q3 and Q1, the semi-interquartile range is 1/2 the distance needed to cover 1/2 the scores. In a symmetric distribution, an interval stretching from one semi-interquartile range below the median to one semi-interquartile above the median will contain 1/2 of the scores. This will not be true for a skewed distribution, however. The semi-interquartile range is little affected by extreme scores, so it is a good measure of spread for skewed distributions. However, it is more subject to sampling fluctuation in normal distributions than is the standard deviation and therefore not often used for data that are approximately normally distributed.

Significance Level: In hypothesis testing, the significance level is the probability threshold used for rejecting the null hypothesis. The significance level is used in hypothesis testing as follows: First, the results of the experiment are compared with the results that would be expected if the null hypothesis were true. Then, assuming the null hypothesis is true, the probability of observing as or more extreme results is computed. Finally, this probability is compared to the significance level. If the probability is less than or equal to the significance level, then the null hypothesis is rejected and the outcome is said to be statistically significant. Traditionally, experimenters have used either the 0.05 level (sometimes called the 5% level) or the 0.01 level (1% level), although the choice of levels is largely subjective. The lower the significance level, the more the data must diverge from the null hypothesis to be significant. Therefore, the 0.01 level is more conservative than the 0.05 level. The Greek letter alpha (α) is used to indicate the significance level.

Significance Test: A significance test is performed to determine if an observed value of a statistic differs enough from a hypothesized value of a parameter to draw the inference that the hypothesized value of the parameter is not the true value. The hypothesized value of the parameter is called the "null hypothesis". A significance test consists of calculating the probability of obtaining a statistic as or more extreme than the statistic obtained in the sample assuming that the null hypothesis is correct. If this probability is sufficiently low, then the difference between the parameter and the statistic is said to be "statistically significant". Just how low is sufficiently low? The choice is somewhat arbitrary but by convention levels of 0.05 and 0.01 are most commonly used. For instance, in Plant Breeder's Rights varietal distinctness based on measured characteristics are often tested at 0.01 level.

Significant: A test is said to be significant if the test statistic supersedes a predetermined threshold.

Simple Effect: A simple effect of a factor is the effect at a single level of another factor. Often simple effects are computed following a significant interaction.

Size of Test: Synonym of Significance Level

Skewness: A measure of lack of symmetry of a distribution.

Spread: See Dispersion

Standard Deviation: It is the square root of the average squared deviation of each observation from the arithmetic mean. In other words it is the square root of variance. See Variance

Standard Error: The standard error of a statistic is the standard deviation of the sampling distribution of that statistic. Standard errors are important because they reflect how much sampling fluctuation a statistic will show. The inferential statistics involved in the construction of confidence intervals and significance testing are based on standard errors. The standard error of a statistic depends on the sample size. In general, the larger the sample size the smaller the standard error. The standard error of a statistic is usually designated by the Greek letter sigma (σ) with a subscript indicating the statistic. For instance, the standard error of the mean is indicated by the symbol: σ_M.

Standard Error of Mean: The standard error of the mean is designated as: σ_M. It is the standard deviation of the sampling distribution of the mean. The formula for the standard error of the mean is: $\sigma_M = \sigma/\sqrt{N}$, where σ is the standard deviation of the original distribution and N is the sample size (the number of scores each mean is based upon). This formula does not assume a normal distribution. However, many of the uses of the formula do assume a normal distribution. The formula shows that the larger the sample size, the smaller the standard error of the mean. More specifically, the size of the standard error of the mean is inversely proportional to the square root of the sample size.

Standard Normal Distribution: The standard normal distribution is a normal distribution with a mean of 0 and a standard deviation of 1. Normal distributions can be transformed to standard normal distributions by the formula:

$$Z = (X - \mu)/\sigma$$

where X is a score from the original normal distribution, μ is the mean of the original normal distribution, and σ is the standard deviation of original normal distribution. The standard normal distribution is sometimes called the Z-distribution.

Standard Scores: When a set of scores are converted to z-scores, the scores are said to be standardized and are referred to as standard scores. Standard scores have a mean of 0 and a standard deviation of 1.

Standardized Coefficient: When an analysis is performed on variables that have been standardized so that they have variances of 1.0, the estimates that result are known as standardized coefficients; for example, a regression run on original variables produces unstandardized regression coefficients known as b's, while a regression run on standardized variables produces standardized regression coefficients known as betas. (In practice, both types of coefficients can be estimated from the original variables.)

Standardized Variable: A variable that has been transformed by multiplication of all scores by a constant and/or by the addition of a constant to all scores. Often these constants are selected so that the transformed scores have a mean of zero and a variance (and standard deviation) of 1.0.

Statistical Independence: A complete lack of covariation between variables, a lack of association between variables. When used in analysis of variance or covariance, statistical independence between the independent variables is sometimes referred to as a balanced design.

Statistical Measure: A number (a statistic) whose size indicates the magnitude of some quantity of interest e.g., the strength of a relationship, the amount of variation, the size of a difference, the level of income, etc. Examples include means, variances, correlation coefficients, and many others. Statistical measures are different from statistical tests. See also Statistical Test.

Statistical Method: Examples include Analysis of Variance (ANOVA), Modified Joint Regression Analysis, COYD, COYU, and many others.

Statistical Model: is a formalized mathematical expression describing the process that is assumed to have generated a set of observed data. A statistical model provides a general structure for the analysis of the observed data and also makes clear the assumptions that are necessary for the analysis to be valid. The observed data usually comprise a variable of primary importance, i.e. the response variable, and one or more explanatory variables. The usual objective of the analysis is to study the effects of treatments and/or other explanatory variables on the response variable, and so provide a suitable statistical model for the relationship between it and the explanatory variables. Thus the model predicts or explains the response variable using the explanatory variables.

Statistical Significance: Significance tests are performed to see if the null hypothesis can be rejected. If the null hypothesis is rejected, then the effect found in a sample is said to be statistically significant. If the null hypothesis is not rejected, then the effect is not significant. The experimenter chooses a significance level before conducting the statistical analysis. The significance level chosen determines the probability of a Type I error.

Statistical Test: A statistical test can be used to assess the probability that a statistical measure deviates from some pre-selected value (often zero) by no more than would be expected due to the operation of chance if the cases studied were randomly selected from a larger population. Examples include Pearson chi-square, F test, t test, and many others. Statistical tests are different from statistical measures. See also Statistical Measure and Hypothesis Testing.

Statistic: Any numerical quantity (such as the mean) calculated from a sample. Such statistics are used to estimate parameters. The term “statistics” sometimes refers to calculated quantities regardless of whether or not they are from a sample.

Statistics: The word “statistics” is used in several different senses. In the broadest sense, “statistics” refers to a range of techniques and procedures for analyzing data, interpreting data, displaying data, and making decisions based on data. This is what courses in “statistics” generally cover. In a second usage, statistics is used as the plural of statistic.

~~**Stochastic Variable:**~~

Student’s t-Distribution: Student's t-distribution is the distribution of the ratio of a standard normal variable and the square root of a chi-squared variable divided by its degrees of freedom, where the standard normal and the chi-squared variables are independent. It is used to compute probabilities and hence test significance in t-tests. See also t-test. The Student’s t-distribution has one parameter, its degrees of freedom, which is the same as the degrees of freedom of the chi-squared variable it is calculated from. The shape of the Student’s t-distribution resembles the bell shape of a standard normal variable, except that it is a bit lower and wider. As the number of degrees of freedom grows, the Student’s t-distribution approaches the standard normal distribution.

Symmetric Distribution: is a distribution without skewness. Thus its opposing sides are symmetric about the mean and median.

t-Distribution: See Student’s t-distribution.

Test: See Statistical Test

Test Statistic: A numerical quantity calculated from the observations with which a test is performed.

Transformation: A change made to the scores of all cases on a variable by the application of the same mathematical operation(s) to each score. (Common operations include addition of a constant, multiplication by a constant, taking logarithms, arcsine, ranking, bracketing, etc.)

t-Test: A t-test is any of a number of tests based on the t distribution. The general formula for t is:

t = (statistic – hypothesised value) / estimated standard error of statistic

The most common t-test is a test for a difference between two means.

Two-Point Scale: If each case is classified into one of two categories (e.g., present/absent, tall/dwarf, dead/alive) the variable is a two-point scale. For analytic purposes, two-point scales can be treated as nominal scales, ordinal scales, or interval scales.

Type I and Type II Error: There are two kinds of errors that can be made in significance testing: (1) a true null hypothesis can be incorrectly rejected and (2) a false null hypothesis can fail to be rejected. The former error is called a Type I error and the latter error is called a Type II error. These two types of errors are defined in the following table. The probability of a Type I error is designated by the Greek letter alpha (α) and is called the Type I error rate; the probability of a Type II error (the Type II error rate) is designated by the Greek letter beta (β). A Type II error is only an error in the sense that an opportunity to reject the null hypothesis correctly was lost.

		Statistical Decision	
		Reject H_o	Do not Reject H_o
True situation	H_o True	Type I error	Correct
	H_o False	Correct	Type II error

Type of Characteristic: See TGP/8

Type of Expression: See TGP/8

Unbalanced Data: Observations not coming from a balanced design.

Variability: See Dispersion

Variable: A variable is any measured characteristic or attribute that differs for different subjects. For example, if the height of 30 plants were measured, then height would be a variable. Variables can be quantitative or qualitative. (Qualitative variables are sometimes called “categorical variables”). Quantitative variables are measured on an ordinal, interval, or ratio scale; qualitative variables are measured on a nominal scale.

Variance: The variance is a measure of how spread out a distribution is. It is computed as the average squared deviation of each observation from its arithmetic mean. Standard deviation is measured as the square root of variance. Both variance and standard deviation are measures of dispersion of data.

Variance Component: variance estimate of a random term in a mixed model.

Variation: See Dispersion

Weighted Data: Weights are applied when one wishes to adjust the impact of cases in the analysis, e.g., to take account of the number of population units that each case represents. In sample surveys weights are most likely to be used with data derived from sample designs having different selection rates or with data having markedly different subgroup response rates.

Within plot standard deviation: When speaking about variance components this term is commonly used for the variability within experimental units, e.g. within plots. For example, if observations are made on several plants on the same plot it is the standard deviation between these plants.

Z-Distribution: The standard normal distribution is sometimes called the Z-distribution. See Standard Normal Distribution

INDEX OF ALL TERMS

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Abbreviations:	CAJ:	Administrative and Legal Committee
	TC:	Technical Committee
	TC-EDC:	Enlarged Editorial Committee
	TWA:	Technical Working Party for Agricultural Crops
	TWC:	Technical Working Party on Automation and Computer Programs
	TWF:	Technical Working Party for Fruit Crops
	TWO:	Technical Working Party for Ornamental Plants and Forest Trees
	TWV:	Technical Working Party for Vegetables

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[a] The TC agreed that the title of Section 1 should be reviewed if the content extended beyond technical terms, as was the case for the terms currently included.

[b] Moved to Section 1.5 and Section 1.5 modified accordingly (Proposal by the Office of the Union after the TC-EDC meeting).

[c] The TWF agreed that it would be necessary to provide an explanation of orientation, with reference to base and apex, at the beginning of the subsection. The TWV agreed with the TWF proposal. However, the TWV agreed that TGP/14 should explain that it would not be obligatory to illustrate shapes with the point of attachment (base) at the bottom if that was not the natural orientation of the organ on the plant.

[d] The TWA agreed that, in accordance with the explanation in Section 1.4, the terms used in the chart should not imply that they were restricted to the ratios indicated in the chart.

[e] The TWA agreed to add “alate”

[f] Term found in Wikipedia *http://en.wikipedia.org/wiki/File:Leaf_morphology_no_title.png*

[g] Term found in Wikipedia *http://en.wikipedia.org/wiki/Lemniscate*

[h] Illustration provided by Mexico

[i] The TWA agreed that it should be explained that it is necessary to avoid duplication of the same difference in two separate characteristics; in particular, to avoid the use of characteristics for length, width and ratio length/width; and length, width and shape, where the shape related to different length/width ratios.

[j] The TWF, TWO and TWV noted the alternative to develop a single pseudo qualitative characteristic for shape rather than using the individual components of shape, provided that, in such cases, the difference between the states of expression was indicated in an illustration. The TWF, TWO and TWV agreed that that was a possibility which would be useful in some cases.

[k] The TWA proposed to make a cross-reference to Section 2.6 concerning the preference to use 2-dimensional shapes where possible

[l] The TWF proposed to provide an explanation of tree, shrub and semi shrub, based on the definition of shrub in TGP/14 and the explanation in the Test Guidelines for Hawthorn.

[m] Illustrations and explanations reproduced from Wikipedia:
http://en.wikipedia.org/wiki/Inflorescence#Simple_inflorescences

[n] The TC-EDC proposed that TGP/14/1 be adopted without the subsection on color (see document TC/45/5).

[o] Amended text agreed by the TWC

[p] Note: To delete those distributions in the square brackets which are not certain to be included in TGP/8.

[q] Definition provided by Mrs. Sally Watson, as requested by the TWC

[r] The TWC agreed that a definition would be provided by Mrs. Sally Watson (United Kingdom) under mixed models. Mrs. Watson suggested that this definition would be covered by that given for Random term/ Random factor and noted that the term ‘random effect’ was not actually used within TGP/14.

[s] New definition proposed by Mrs. Sally Watson on the basis that it would be better than the current definition for Random term/Random factor (which is to see “Mixed model”) and also balances the definition for Fixed term/Fixed factor, requested by the TWC.

[End of document]