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| |  |  |  | | --- | --- | --- | |  |  | **E** | |  |  |  | |  | wordml://75.png | |  | | --- | | **TG/81/7(proj.6)** | | **ORIGINAL:** English | | **DATE:** 2023-07-13 | | | **INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS** | | | |  | Geneva |  | |  | |  |  |  | | --- | --- | --- | |  |  |  | |  | DRAFT |  | |  |  |  | |  | |  |  |  | |  | |  | | --- | |  | | **SUNFLOWER** | |  | | |  | | --- | |  | | |  | | --- | | UPOV Code(s): HLNTS\_ANN | | |  | | |  | | |  |  | | --- | --- | | |  | | --- | | *Helianthus annuus* L. | | |  | | |  | | |  | | --- | | \* | | |  |  |  | | |  | | --- | | **GUIDELINES** | |  | | **FOR THE CONDUCT OF TESTS** | |  | | **FOR DISTINCTNESS, UNIFORMITY AND STABILITY** | | | | |  |  |  | | |  | | --- | | *prepared by an expert from Hungary* | | *to be considered by the*  *Technical Committee for adoption by correspondence* | | | | | *Disclaimer: this document does not represent UPOV policies or guidance* | | | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | |  | | --- | | Alternative names:\* | | | | | | | |  | | --- | |  | | | | | | | *Botanical name* | *English* | *French* | *German* | *Spanish* | | |  | | --- | | *Helianthus annuus* L. | | |  | | --- | | Common Sunflower | | |  | | --- | | Tournesol, Soleil | | |  | | --- | | Sonnenblume | | |  | | --- | | Girasol | | | | | |  |  |  | | The purpose of these guidelines (“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. | | | |  | | | | |  | | --- | | **ASSOCIATED DOCUMENTS** | | These Test Guidelines should be read in conjunction with the General Introduction and its associated TGP documents. | |  | | | | |

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| | 9. | LITERATURE......................................................................................................................................................... | [28](#Section9) | |  |  |  | | 10. | TECHNICAL QUESTIONNAIRE............................................................................................................................ | [29](#Section10) | |  |  |  | |  | |  | | --- | |  | |  | | | |

ANNEX Additional Useful Explanations

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| --- | --- |
| 1. | Subject of these Test Guidelines |
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|  | |  | | --- | | These Test Guidelines apply to all varieties of *Helianthus annuus* L. (excluding ornamental varieties). | |

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| --- | --- |
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| 2. | Material Required |
|  |  |
| 2.1 | |  | | --- | | The competent authorities decide on the quantity and quality of the plant material required for testing the variety and when and where it is to be delivered. Applicants submitting material from a State other than that in which the testing takes place must ensure that all customs formalities and phytosanitary requirements are complied with. | |
|  |  |
| 2.2 | |  | | --- | | The material is to be supplied in the form of seed. | |
|  |  |
| 2.3 | |  | | --- | | The minimum quantity of plant material, to be supplied by the applicant, should be: | |
|  |  |
|  | |  | | --- | | 5,000 seeds for inbred lines  1 kg of seed for hybrid and open-pollinated varieties  In the case of hybrid varieties, an additional 5000 seeds of each component (e.g. for a single hybrid, the female lines (male sterile line and maintainer line) and the male line) should be submitted. In the case of male sterile lines, an additional 5000 seeds of the maintainer line should be submitted. | |
|  |  |
|  | The seed should meet the minimum requirements for germination, species and analytical purity, health and moisture content, specified by the competent authority. In cases where the seed is to be stored, the germination capacity should be as high as possible and should, be stated by the applicant. |
|  |  |
| 2.4 | |  | | --- | | The plant material supplied should be visibly healthy, not lacking in vigor, nor affected by any important pest or disease. | |
|  |  |
| 2.5 | |  | | --- | | The plant material should not have undergone any treatment which would affect the expression of the characteristics of the variety, unless the competent authorities allow or request such treatment. If it has been treated, full details of the treatment must be given. | |

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| 3. | Method of Examination |
|  |  |
| *3.1* | *Number of Growing Cycles* |
|  |  |
| |  | | --- | | 3.1.1 | | The minimum duration of tests should normally be two independent growing cycles. |
|  |  |
| |  | | --- | | 3.1.2 | | The testing of a variety may be concluded when the competent authority can determine with certainty the outcome of the test. |
|  |  |
| *3.2* | *Testing Place* |
|  |  |
|  | Tests are normally conducted at one place. In the case of tests conducted at more than one place, guidance is provided in TGP/9 “Examining Distinctness”. |
|  |  |
| *3.3* | *Conditions for Conducting the Examination* |
|  |  |
| |  | | --- | | 3.3.1 | | The tests should be carried out under conditions ensuring satisfactory growth for the expression of the relevant characteristics of the variety and for the conduct of the examination. |
|  |  |

|  |  |
| --- | --- |
| 3.3.2 | The optimum stage of development for the assessment of each characteristic is indicated by a number in the Table of Characteristics. The stages of development denoted by each number are described in Chapter 8.3 |
|  |  |

|  |  |
| --- | --- |
| *3.4* | *Test Design* |
|  |  |
| 3.4.1 | |  | | --- | | Each test should be designed to result in a total of at least 40 plants, which should be divided between at least 2 replicates. | |
|  |  |
| |  | | --- | | 3.4.2 | | |  | | --- | | The design of the tests should be such that plants or parts of plants may be removed for measurement or counting without prejudice to the observations which must be made up to the end of the growing cycle. | |
|  |  |
| |  | | --- | |  |   *3.5* | *Additional Tests* |
|  |  |
|  | Additional tests, for examining relevant characteristics, may be established. |

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|  |  |
| 4. | Assessment of Distinctness, Uniformity and Stability |
|  |  |
| *4.1* | *Distinctness* |
|  |  |
| 4.1.1 | General Recommendations |
|  |  |
|  | It is of particular importance for users of these Test Guidelines to consult the General Introduction prior to making decisions regarding distinctness. However, the following points are provided for elaboration or emphasis in these Test Guidelines. |
|  |  |
|  | |  | | --- | | To assess distinctness of hybrids, the parent lines and the formula may be used according to the following recommendations: | |  | | (i) description of parent lines according to the Test Guidelines; | |  | | (ii) check of the originality of the parent lines in comparison with the variety collection, based on the characteristics in Chapter 7, in order to identify similar parent lines; | |  | | (iii) check of the originality of the hybrid formula in relation to the hybrids in the variety collection, taking into account the most similar lines; and | |  | | (iv) assessment of the distinctness at the hybrid level for varieties with a similar formula. | |  | | Further guidance is provided in documents TGP/9 "Examining Distinctness" and TGP/8 "Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability". | |
|  |  |
| 4.1.2 | Consistent Differences |
|  |  |
|  | The differences observed between varieties may be so clear that more than one growing cycle is not necessary. In addition, in some circumstances, the influence of the environment is not such that more than a single growing cycle is required to provide assurance that the differences observed between varieties are sufficiently consistent. One means of ensuring that a difference in a characteristic, observed in a growing trial, is sufficiently consistent is to examine the characteristic in at least two independent growing cycles. |
|  |  |
| 4.1.3 | Clear Differences |
|  |  |
|  | Determining whether a difference between two varieties is clear depends on many factors, and should consider, in particular, the type of expression of the characteristic being examined, i.e. whether it is expressed in a qualitative, quantitative, or pseudo-qualitative manner. Therefore, it is important that users of these Test Guidelines are familiar with the recommendations contained in the General Introduction prior to making decisions regarding distinctness. |
|  |  |
| 4.1.4 | |  | | --- | | Number of Plants or Parts of Plants to be Examined | |
|  |  |

|  |  |  |
| --- | --- | --- |
|  | |  | | --- | | Unless otherwise indicated, for the purposes of distinctness, all observations on single plants should be made on 36 plants or parts of plants taken from each of 36 plants and any other observations made on all plants in the test, disregarding any off-type plants. | |
|  |  |

|  |  |
| --- | --- |
| 4.1.5 | Method of Observation |
|  |  |
|  | The recommended method of observing the characteristic for the purposes of distinctness is indicated by the following key in the Table of Characteristics (see document TGP/9 “Examining Distinctness”, Section 4 “Observation of characteristics”): |
|  |  |
|  | |  | | --- | | MG: single measurement of a group of plants or parts of plants  MS: measurement of a number of individual plants or parts of plants  VG: visual assessment by a single observation of a group of plants or parts of plants  VS: visual assessment by observation of individual plants or parts of plants | |
|  |  |
|  | Type of observation: visual (V) or measurement (M) |
|  |  |
|  | “Visual” observation (V) is an observation made on the basis of the expert’s judgment. 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). Measurement (M) is an objective observation against a calibrated, linear scale e.g. using a ruler, weighing scales, colorimeter, dates, counts, etc. |
|  |  |
|  | |  | | --- | | Type of record: for a group of plants (G) or for single, individual plants (S) | |
|  |  |
|  | |  | | --- | | 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). In most cases, “G” provides a single record per variety and it is not possible or necessary to apply statistical methods in a plant-by-plant analysis for the assessment of distinctness. | |
|  |  |
|  | In cases where more than one method of observing the characteristic is indicated in the Table of Characteristics (e.g. VG/MG), guidance on selecting an appropriate method is provided in document TGP/9, Section 4.2. |
|  |  |
| *4.2* | *Uniformity* |
|  |  |
| 4.2.1 | It is of particular importance for users of these Test Guidelines to consult the General Introduction prior to making decisions regarding uniformity. However, the following points are provided for elaboration or emphasis in these Test Guidelines: |
|  |  |
| |  | | --- | | 4.2.2 | | |  | | --- | | These Test Guidelines have been developed for the examination of seed-propagated varieties. For varieties with other types of propagation, the recommendations in the General Introduction and document TGP/13 "Guidance for new types and species" Section 4.5 "Testing Uniformity" should be followed. | |
|  |  |
| |  | | --- | | 4.2.3 | | The assessment of uniformity for open-pollinated varieties should be according to the recommendations for cross-pollinated varieties in the General Introduction. |
|  |  |
| 4.2.4 | The assessment of uniformity for hybrid varieties depends on the type of hybrid and should be according to the recommendations for hybrid varieties in the General Introduction. |
|  |  |
| 4.2.5 | Where the assessment of a hybrid variety involves the parent lines, the uniformity of the hybrid variety should, in addition to an examination of the hybrid variety itself, also be assessed by examination of the uniformity of its parent lines. |
|  |  |

|  |  |  |
| --- | --- | --- |
| 4.2.6 | |  | | --- | | For the assessment of uniformity of inbred lines, a population standard of 2% and an acceptance probability of at least 95% should be applied. In the case of a sample size of 36 plants, 2 off-types are allowed. In addition, the same population standard and acceptance probability should apply for the assessment of uniformity regarding out-crosses and isogenic male fertile plants in a male sterile line. For the assessment of uniformity of single hybrids, a population standard of 5% with an acceptance probability of at least 95% should be applied. In the case of a sample size of 36 plants, 4 off-types are allowed. For three-way hybrids and open-pollinated varieties, the variability within the variety should not exceed the variability of comparable varieties already known. | |
|  |  |
| *4.3* | *Stability* |
|  |  |
| 4.3.1 | In practice, it is not usual to perform tests of stability that produce results as certain as those of the testing of distinctness and uniformity. However, experience has demonstrated that, for many types of variety, when a variety has been shown to be uniform, it can also be considered to be stable. |
|  |  |
| 4.3.2 | Where appropriate, or in cases of doubt, stability may be further examined by testing a new seed stock to ensure that it exhibits the same characteristics as those shown by the initial material supplied. |
|  |  |
| 4.3.3 | Where appropriate, or in cases of doubt, the stability of a hybrid variety may, in addition to an examination of the hybrid variety itself, also be assessed by examination of the uniformity and stability of its parent lines. |

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| 5. | Grouping of Varieties and Organization of the Growing Trial |
|  |  |
| 5.1 | The selection of varieties of common knowledge to be grown in the trial with the candidate varieties and the way in which these varieties are divided into groups to facilitate the assessment of distinctness are aided by the use of grouping characteristics. |
|  |  |
| 5.2 | 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. |
|  |  |
| 5.3 | The following have been agreed as useful grouping characteristics: |
|  | |  |  |  | | --- | --- | --- | |  |  |  | | |  | | --- | | (a) | |  | |  | | --- | | Leaf: intensity of green color (characteristic 2) | | | |  | | --- | | (b) | |  | |  | | --- | | Leaf: blistering (characteristic 3) | | | |  | | --- | | (c) | |  | |  | | --- | | Time of beginning of flowering (characteristic 11) | | | |  | | --- | | (d) | |  | |  | | --- | | Ray floret: color (characteristic 17) | | | |  | | --- | | (e) | |  | |  | | --- | | Disc floret: production of pollen (characteristic 22) | | | |  | | --- | | (f) | |  | |  | | --- | | Only inbred lines: Plant: natural height (characteristic 27) | | | |  | | --- | | (g) | |  | |  | | --- | | Only hybrids and open-pollinated varieties: Plant: natural height (characteristic 28) | | | |  | | --- | | (h) | |  | |  | | --- | | Plant: branching  (characteristic 29) | | | |  | | --- | | (i) | |  | |  | | --- | | Seed: color (characteristic 39) | | | |  | | --- | | (j) | |  | |  | | --- | | Seed: stripes on margin (characteristic 40) | | |
|  | |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  | | --- | | (k) | |  | |  | | --- | | Seed: stripes between margins (characteristic 41) | | | |  |  | | --- | --- | | |  | | --- | |  | | | | | |
| 5.4 | Guidance for the use of grouping characteristics, in the process of examining distinctness, is provided through the General Introduction and document TGP/9 “Examining Distinctness”. |

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| 6. | Introduction to the Table of Characteristics |
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| *6.1* | *Categories of Characteristics* |
| 6.1.1 | Standard Test Guidelines Characteristics |
|  | 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. |
| 6.1.2 | Asterisked Characteristics |
|  | 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. |
| *6.2* | *States of Expression and Corresponding Notes* |
| 6.2.1 | States of expression are given for each characteristic 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. |
| 6.2.2 | All relevant states of expression are presented in the characteristic. |
|  |  |
| 6.2.3 | Further explanation of the presentation of states of expression and notes is provided in document TGP/7 “Development of Test Guidelines”. |
| *6.3* | *Types of Expression* |
|  | An explanation of the types of expression of characteristics (qualitative, quantitative and pseudo-qualitative) is provided in the General Introduction. |
| *6.4* | *Example Varieties* |
|  | Where appropriate, example varieties are provided to clarify the states of expression of each characteristic. |

|  |  |
| --- | --- |
| *6.5* | *Legend* |
|  |  |
| |  |  | English | | français | | deutsch | español | Example Varieties  Exemples  Beispielssorten  Variedades ejemplo | Note/  Nota | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  | | --- | | **1** | | |  | | --- | | **2** | | |  | | --- | | **3** | | |  | | --- | | **4** | | |  | | --- | | **5** | | |  | | --- | | **6** | | |  | | --- | | **7** | | | | | |  |  | |  | | --- | | **Name of characteristics in English** | | | |  | | --- | | **Nom du caractère en français** | | | |  | | --- | | **Name des Merkmals auf Deutsch** | | |  | | --- | | **Nombre del carácter en español** | |  |  | |  |  | |  | | --- | | states of expression | | | |  | | --- | | types d’expression | | | |  | | --- | | Ausprägungsstufen | | |  | | --- | | tipos de expresión | | |  | | --- | |  | |  | |  |  |  |  |  |  |  |  |  |  | | |
| |  |  |  |  | | --- | --- | --- | --- | | 1 | Characteristic number | | | |  |  |  |  | | 2 | (\*) | Asterisked characteristic | – see Chapter 6.1.2 | |  |  |  |  | | 3 | Type of expression | | | |  | QL | Qualitative characteristic | – see Chapter 6.3 | |  | QN | Quantitative characteristic | – see Chapter 6.3 | |  | PQ | Pseudo-qualitative characteristic | – see Chapter 6.3 | |  |  |  |  | | 4 | Method of observation (and type of plot, if applicable) | | | |  | MG, MS, VG, VS | | – see Chapter 4.1.5 | |  |  |  |  | | 5 | |  | | --- | | (+) | | |  |  | | --- | --- | | |  | | --- | | See Explanations on the Table of Characteristics in Chapter 8.2 | | | | |  |  |  |  | | 6 | |  | | --- | | (a) | | |  |  | | --- | --- | | |  | | --- | | See Explanations on the Table of Characteristics in Chapter 8.1 | | | | |  |  |  |  | | 7 | |  | | --- | | Growth stage key See Explanations on the Table of Characteristics in Chapter 8.3 | | | | | |

|  |  |
| --- | --- |
| 7. | Table of Characteristics/Tableau des caractères/Merkmalstabelle/Tabla de caracteres |

|  |  | English | | français | | deutsch | español | Example Varieties  Exemples  Beispielssorten  Variedades ejemplo | Note/  Nota |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1.** |  | **QN** | **VG** |  |  | **10** | | | |
|  |  | |  | | --- | | **Seedling: anthocyanin coloration of hypocotyl** | | | |  | | --- | | **Plantule : pigmentation anthocyanique de l’hypocotyle** | | | |  | | --- | | **Keimpflanze: Anthocyanfärbung des Hypokotyls** | | |  | | --- | | **Plántula: pigmentación antociánica del hipocótilo** | |  |  |
|  |  | absent or very weak | | absente ou très faible | | fehlend oder sehr gering | ausente o muy débil | T0954LM | 1 |
|  |  | weak | | faible | | gering | débil | OB724 | 2 |
|  |  | medium | | moyenne | | mittel | media | TRC3285 | 3 |
|  |  | strong | | forte | | stark | fuerte | F7AW1MOA | 4 |
|  |  | very strong | | très forte | | sehr stark | muy fuerte | Kisvárdai | 5 |
| **2.** | **(\*)** | **QN** | **VG** |  | **(a)** | **51-55** | | | |
|  |  | |  | | --- | | **Leaf: intensity of green color** | | | |  | | --- | | **Feuille : intensité de la couleur verte** | | | |  | | --- | | **Blatt: Intensität der Grünfärbung** | | |  | | --- | | **Hoja: intensidad del color verde** | |  |  |
|  |  | very light | | très claire | | sehr hell | muy clara | F5DN3MA, T0243HG | 1 |
|  |  | light | | claire | | hell | clara |  | 2 |
|  |  | medium | | moyenne | | mittel | media | H11050R | 3 |
|  |  | dark | | foncée | | dunkel | oscura |  | 4 |
|  |  | very dark | | très foncée | | sehr dunkel | muy oscura | 13013 | 5 |
| **3.** | **(\*)** | **QN** | **VG** |  | **(a)** | **51-55** | | | |
|  |  | |  | | --- | | **Leaf: blistering** | | | |  | | --- | | **Feuille : gaufrure** | | | |  | | --- | | **Blatt: Blasigkeit** | | |  | | --- | | **Hoja: abullonado** | |  |  |
|  |  | absent or very weak | | absente ou très faible | | fehlend oder sehr gering | ausente o muy débil | F5DN3MA | 1 |
|  |  | very weak to weak | | très faible à faible | | sehr gering bis gering | muy débil a débil |  | 2 |
|  |  | weak | | faible | | gering | débil | F7AX2JA, IR79DMR | 3 |
|  |  | weak to medium | | faible à moyenne | | gering bis mittel | débil a medio |  | 4 |
|  |  | medium | | moyenne | | mittel | medio | HA89, IB1088DMR | 5 |
|  |  | medium to strong | | moyenne à forte | | mittel bis stark | medio a fuerte |  | 6 |
|  |  | strong | | forte | | stark | fuerte | TRC2342 | 7 |
|  |  | strong to very strong | | forte à très forte | | stark bis sehr stark | fuerte a muy fuerte |  | 8 |
|  |  | very strong | | très forte | | sehr stark | muy fuerte |  | 9 |
| **4.** | **(\*)** | **QN** | **VG** | **(+)** | **(a)** | **51-55** | | | |
|  |  | |  | | --- | | **Leaf: serration** | | | |  | | --- | | **Feuille : denture** | | | |  | | --- | | **Blatt: Randeinschnitte** | | |  | | --- | | **Hoja: serrado** | |  |  |
|  |  | isolated or very fine | | isolée ou très fine | | vereinzelt oder sehr fein | aislado o muy fino | 99D40R | 1 |
|  |  | very fine to fine | | très fine à fine | | sehr fein bis fein | muy fino a fino |  | 2 |
|  |  | fine | | fine | | fein | fino | IR79DMR | 3 |
|  |  | fine to medium | | fine à moyenne | | fein bis mittel | fino a medio |  | 4 |
|  |  | medium | | moyenne | | mittel | medio | HA89, TRC2342 | 5 |
|  |  | medium to coarse | | moyenne à grossière | | mittel bis grob | medio a grosero |  | 6 |
|  |  | coarse | | grossière | | grob | grosero | PB1458DMR | 7 |
|  |  | coarse to very coarse | | grossière à très grossière | | grob bis sehr grob | grosero a muy grosero |  | 8 |
|  |  | very coarse | | très grossière | | sehr grob | muy grosero |  | 9 |
| **5.** |  | **QN** | **VG** | **(+)** | **(a)** | **53-55** | | | |
|  |  | |  | | --- | | **Leaf: profile in cross‑section** | | | |  | | --- | | **Feuille : profil en section transversale** | | | |  | | --- | | **Blatt: Profil im Querschnitt** | | |  | | --- | | **Hoja: perfil en sección transversal** | |  |  |
|  |  | strongly concave | | fortement concave | | stark konkav | fuertemente cóncavo | RT9513 | 1 |
|  |  | weakly concave | | faiblement concave | | schwach konkav | débilmente cóncavo |  | 2 |
|  |  | flat | | plate | | gerade | plano | PH5002R | 3 |
|  |  | weakly convex | | faiblement convexe | | schwach konvex | débilmente convexo |  | 4 |
|  |  | strongly convex | | fortement convexe | | stark konvex | fuertemente convexo |  | 5 |
| **6.** |  | **PQ** | **VG** | **(+)** | **(a)** | **53-55** | | | |
|  |  | |  | | --- | | **Leaf: shape** | | | |  | | --- | | **Feuille : forme** | | | |  | | --- | | **Blatt: Form** | | |  | | --- | | **Hoja: forma** | |  |  |
|  |  | elliptic | | elliptique | | elliptisch | elíptica | FR810RM1 | 1 |
|  |  | very narrow triangular | | triangulaire très étroite | | sehr schmal dreieckig | triangular muy estrecha | FR81013 | 2 |
|  |  | narrow triangular | | triangulaire étroite | | schmal dreieckig | triangular estrecha | RT0976 | 3 |
|  |  | medium triangular | | triangulaire moyenne | | mittel dreieckig | triangular media | RT9513 | 4 |
|  |  | broad triangular | | triangulaire large | | breit dreieckig | triangular ancha | BT0835 | 5 |
|  |  | triangular to rounded | | triangulaire à arrondie | | dreieckig bis abgerundet | triangular a redondeada |  | 6 |
|  |  | rounded | | arrondie | | abgerundet | redondeada |  | 7 |
| **7.** | **(\*)** | **QN** | **VG** | **(+)** | **(a)** | **53-55** | | | |
|  |  | |  | | --- | | **Leaf: lobes** | | | |  | | --- | | **Feuille : lobes** | | | |  | | --- | | **Blatt: Lappen** | | |  | | --- | | **Hoja: lóbulos** | |  |  |
|  |  | absent or very small | | absents ou très petits | | fehlend oder sehr klein | ausentes o muy pequeños | 37025 | 1 |
|  |  | very small to small | | très petits à petits | | sehr klein bis klein | muy pequeños a pequeños |  | 2 |
|  |  | small | | petits | | klein | pequeños | T0954LM | 3 |
|  |  | small to medium | | petits à moyens | | klein bis mittel | pequeños a medias |  | 4 |
|  |  | medium | | moyens | | mittel | medios |  | 5 |
|  |  | medium to large | | moyens à grands | | mittel bis groß | medios a grandes |  | 6 |
|  |  | large | | grands | | groß | grandes | F6AH6MO, HA89 | 7 |
|  |  | large to very large | | grands à très grands | | groß bis sehr groß | grandes a muy grandes |  | 8 |
|  |  | very large | | très grands | | sehr groß | muy grandes | RHA299 | 9 |
| **8.** |  | **QN** | **VG** | **(+)** | **(a)** | **53-55** | | | |
|  |  | |  | | --- | | **Leaf: parenchyma at base of lateral veins** | | | |  | | --- | | **Feuille : parenchyme à la base des nervures latérales** | | | |  | | --- | | **Blatt: Parenchym an der Basis der untersten Seitennerven** | | |  | | --- | | **Hoja: parénquima en la base de los nervios laterales** | |  |  |
|  |  | none or very weak | | absent ou très faible | | fehlend oder sehr gering | ausente o muy débil | T0954LM | 1 |
|  |  | weak | | faible | | gering | débil | F7AW1MOA | 2 |
|  |  | strong | | fort | | stark | fuerte | 13013 | 3 |
| **9.** | **(\*)** | **QN** | **VG** | **(+)** | **(a)** | **53-55** | | | |
|  |  | |  | | --- | | **Leaf: angle of lowest lateral veins** | | | |  | | --- | | **Feuille : angle des nervures latérales les plus basses** | | | |  | | --- | | **Blatt: Winkel der untersten Seitenadern** | | |  | | --- | | **Hoja: ángulo de los nervios laterales inferiores** | |  |  |
|  |  | acute | | aigu | | spitz | agudo | T0860LM | 1 |
|  |  | right angle or nearly right angle | | droit ou presque droit | | rechtwinklig oder fast rechtwinklig | ángulo recto o casi ángulo recto | F7AW1MOA | 2 |
|  |  | obtuse | | obtus | | stumpf | obtuso | TFC3767B | 3 |
| **10.** | **(\*)** | **QN** | **MS/VG** |  | **(a)** | **55-57** | | | |
|  |  | |  | | --- | | **Leaf: size** | | | |  | | --- | | **Feuille : taille** | | | |  | | --- | | **Blatt: Größe** | | |  | | --- | | **Hoja: tamaño** | |  |  |
|  |  | very small | | très petite | | sehr klein | muy pequeño |  | 1 |
|  |  | very small to small | | très petite à petite | | sehr klein bis klein | muy pequeño a pequeño |  | 2 |
|  |  | small | | petite | | klein | pequeño | PH5002R | 3 |
|  |  | small to medium | | petite à moyenne | | klein bis mittel | pequeño a medio |  | 4 |
|  |  | medium | | moyenne | | mittel | medio | LC1093, OB724 | 5 |
|  |  | medium to large | | moyenne à grande | | mittel bis groß | medio a grande |  | 6 |
|  |  | large | | grande | | groß | grande | IA1169DMR | 7 |
|  |  | large to very large | | grande à très grande | | groß bis sehr groß | grande a muy grande |  | 8 |
|  |  | very large | | très grande | | sehr groß | muy grande |  | 9 |
| **11.** | **(\*)** | **QN** | **MG/MS** | **(+)** |  | **61** | | | |
|  |  | |  | | --- | | **Time of beginning of flowering** | | | |  | | --- | | **Époque du début de la floraison** | | | |  | | --- | | **Zeitpunkt des Blühbeginns** | | |  | | --- | | **Época de inicio de la floración** | |  |  |
|  |  | very early | | très précoce | | sehr früh | muy temprana | PHA283 | 1 |
|  |  | very early to early | | très précoce à précoce | | sehr früh bis früh | muy temprana a temprana |  | 2 |
|  |  | early | | précoce | | früh | temprana | T0860LM | 3 |
|  |  | early to medium | | précoce à moyenne | | früh bis mittel | temprana a media |  | 4 |
|  |  | medium | | moyenne | | mittel | media | H11050R, RHA274 | 5 |
|  |  | medium to late | | moyenne à tardive | | mittel bis spät | media a tardía |  | 6 |
|  |  | late | | tardive | | spät | tardía | RT7710 | 7 |
|  |  | late to very late | | tardive à très tardive | | spät bis sehr spät | tardía a muy tardía |  | 8 |
|  |  | very late | | très tardive | | sehr spät | muy tardía | Kisvárdai, LGR27 | 9 |
| **12.** |  | **QN** | **VG** | **(+)** |  | **63-65** | | | |
|  |  | |  | | --- | | **Ray floret: attitude of base in relation to head** | | | |  | | --- | | **Fleur ligulée: port de la base par rapport au capitule** | | | |  | | --- | | **Zungenblüte: Haltung der Basis im Verhältnis zum Kopf** | | |  | | --- | | **Flor ligulada: porte de la base en relación con el capítulo** | |  |  |
|  |  | erect | | dressé | | aufgerichtet | erecto | T0833HG | 1 |
|  |  | semi-erect | | demi-dressé | | halbaufgerichtet | semierecto |  | 2 |
|  |  | horizontal | | horizontal | | waagerecht | horizontal | T0954LM | 3 |
| **13.** |  | **PQ** | **VG** | **(+)** |  | **63-65** | | | |
|  |  | |  | | --- | | **Ray floret: profil** | | | |  | | --- | | **Fleur ligulée : profil** | | | |  | | --- | | **Zungenblüte: Profil** | | |  | | --- | | **Flor ligulada: perfil** | |  |  |
|  |  | flat | | plat | | eben | plano | HA89, IR79DMR | 1 |
|  |  | rolled | | enroulé | | gerollt | enrollado | PH5002R | 2 |
|  |  | twisted | | torsadé | | gedreht | torcido | F5DN3MA | 3 |
|  |  | strongly recurved | | fortement recourbé | | stark gebogen | fuertemente recurvado |  | 4 |
| **14.** |  | **QN** | **VG** |  |  | **63-65** | | | |
|  |  | |  | | --- | | **Flower: density of ray florets** | | | |  | | --- | | **Fleur : densité des fleurs ligulées** | | | |  | | --- | | **Blüte: Dichte der Zungenblüten** | | |  | | --- | | **Flor: densidad de las flores liguladas** | |  |  |
|  |  | very sparse | | très lâche | | sehr locker | muy laxa | T0954LM | 1 |
|  |  | sparse | | lâche | | locker | laxa |  | 2 |
|  |  | medium | | moyenne | | mittel | media | 99D40R, HA89 | 3 |
|  |  | dense | | dense | | dicht | densa |  | 4 |
|  |  | very dense | | très dense | | sehr dicht | muy densa | OB724 | 5 |
| **15.** |  | **QN** | **MS/VG** |  |  | **63-65** | | | |
|  |  | |  | | --- | | **Ray floret: length** | | | |  | | --- | | **Fleur ligulée : longueur** | | | |  | | --- | | **Zungenblüte: Länge** | | |  | | --- | | **Flor ligulada: longitud** | |  |  |
|  |  | very short | | très courte | | sehr kurz bis kurz | muy corta | BT0835 | 1 |
|  |  | short | | courte | | kurz | corta |  | 2 |
|  |  | medium | | moyenne | | mittel | media | SF9074MA | 3 |
|  |  | long | | longue | | lang | larga |  | 4 |
|  |  | very long | | très longue | | sehr lang bis sehr lang | muy larga | T0954LM | 5 |
| **16.** |  | **QN** | **MS/VG** | **(+)** |  | **63-65** | | | |
|  |  | |  | | --- | | **Ray floret: width in relation to length** | | | |  | | --- | | **Fleur ligulée : largeur par rapport à la longueur** | | | |  | | --- | | **Zungenblüte: Breite im Verhältnis zur Länge** | | |  | | --- | | **Flor ligulada: anchura en relación con la longitud** | |  |  |
|  |  | very narrow | | très étroite | | sehr schmal | muy estrecha | T0954LM | 1 |
|  |  | narrow | | étroite | | schmal | estrecha | HA850, OB724 | 2 |
|  |  | broad | | large | | breit | ancha |  | 3 |
|  |  | very broad | | très large | | sehr breit | muy ancha |  | 4 |
| **17.** | **(\*)** | **PQ** | **VG** | **(+)** |  | **63-65** | | | |
|  |  | |  | | --- | | **Ray floret: color** | | | |  | | --- | | **Fleur ligulée : couleur** | | | |  | | --- | | **Zungenblüte: Farbe** | | |  | | --- | | **Flor ligulada: color** | |  |  |
|  |  | yellowish white | | blanc jaunâtre | | gelblichweiß | blanco amarillento | RHA381 | 1 |
|  |  | light yellow | | jaune clair | | hellgelb | amarillo claro | F7AW1MOA | 2 |
|  |  | medium yellow | | jaune moyen | | mittelgelb | amarillo medio | RT7710 | 3 |
|  |  | orange yellow | | jaune orange | | orangegelb | amarillo anaranjado | U0881BG | 4 |
|  |  | orange | | orange | | orange | naranja | OB724, P211R | 5 |
|  |  | purple | | pourpre | | purpurn | púrpura |  | 6 |
|  |  | reddish brown | | brun rougeâtre | | rötlichbraun | marrón rojizo |  | 7 |
| **18.** |  | **QL** | **VG** | **(+)** |  | **63-65** | | | |
|  |  | |  | | --- | | **Disc floret: anthocyanin coloration of pappus** | | | |  | | --- | | **Fleuron : pigmentation anthocyanique du pappus** | | | |  | | --- | | **Röhrenblüte: Anthocyanfärbung des Pappus** | | |  | | --- | | **Flósculo: pigmentación antociánica del papus** | |  |  |
|  |  | absent | | absente | | fehlend | ausente | F7EW4IMO | 1 |
|  |  | present | | présente | | vorhanden | presente | OKD4447R, TRC2342 | 9 |
| **19.** |  | **PQ** | **VG** |  |  | **63-65** | | | |
|  |  | |  | | --- | | **Disc floret: color** | | | |  | | --- | | **Fleuron : couleur** | | | |  | | --- | | **Röhrenblüte: Farbe** | | |  | | --- | | **Flósculo: color** | |  |  |
|  |  | yellow | | jaune | | gelb | amarillo | STR226, TRC2342 | 1 |
|  |  | orange | | orange | | orange | naranja | F7AW1MOA, HA89 | 2 |
|  |  | purple | | pourpre | | purpurn | púrpura |  | 3 |
| **20.** |  | **QL** | **VG** | **(+)** |  | **63-65** | | | |
|  |  | |  | | --- | | **Disc floret: anthocyanin coloration of anthers** | | | |  | | --- | | **Fleuron : pigmentation anthocyanique des anthères** | | | |  | | --- | | **Röhrenblüte: Anthocyanfärbung der Antheren** | | |  | | --- | | **Flósculo: pigmentación antociánica de las anteras** | |  |  |
|  |  | absent | | absente | | fehlend | ausente | R4NO4MJ | 1 |
|  |  | present | | présente | | vorhanden | presente | R5XY3MJS | 9 |
| **21.** |  | **QN** | **VG** | **(+)** |  | **63-65** | | | |
|  |  | |  | | --- | | **Disc floret: anthocyanin coloration of stigma** | | | |  | | --- | | **Fleuron : pigmentation anthocyanique du stigmate** | | | |  | | --- | | **Röhrenblüte: Anthocyanfärbung der Narbe** | | |  | | --- | | **Flósculo: pigmentación antociánica del estigma** | |  |  |
|  |  | absent or very weak | | absente ou très faible | | fehlend oder sehr gering | ausente o muy débil | SF9074MA | 1 |
|  |  | weak | | faible | | gering | débil | RT7710 | 2 |
|  |  | medium | | moyenne | | mittel | media | R6ST2MI, TRC2342 | 3 |
|  |  | strong | | forte | | stark | fuerte | F7AW1MOA | 4 |
|  |  | very strong | | très forte | | sehr stark | muy fuerte | Kisvárdai | 5 |
| **22.** | **(\*)** | **QL** | **VG** |  |  | **63-65** | | | |
|  |  | |  | | --- | | **Disc floret: production of pollen** | | | |  | | --- | | **Fleuron: production de pollen** | | | |  | | --- | | **Scheibenblüte: Pollenproduktion** | | |  | | --- | | **Flósculo: producción de polen** | |  |  |
|  |  | absent | | absente | | fehlend | ausente | F7AW1MOA, HA89 | 1 |
|  |  | present | | présente | | vorhanden | presente | IR79DMR, RHA274 | 9 |
| **23.** |  | **PQ** | **VG** | **(+)** |  | **63-65** | | | |
|  |  | |  | | --- | | **Bract: shape** | | | |  | | --- | | **Bractée : forme** | | | |  | | --- | | **Hüllblatt: Form** | | |  | | --- | | **Bráctea: forma** | |  |  |
|  |  | narrow acute | | aiguë étroite | | schmal spitz | aguda estrecha | T0954LM | 1 |
|  |  | broad acute | | aiguë large | | breit spitz | aguda ancha | IR79DMR | 2 |
|  |  | rounded | | arrondie | | abgerundet | redondeada | IB1088DMR | 3 |
| **24.** |  | **QN** | **MS/VG** | **(+)** |  | **63-65** | | | |
|  |  | |  | | --- | | **Bract: length of tip** | | | |  | | --- | | **Bractée : longueur de l'extrémité** | | | |  | | --- | | **Hüllblatt: Länge der Spitze** | | |  | | --- | | **Bráctea: longitud de la punta** | |  |  |
|  |  | very short | | très courte | | sehr kurz | muy corta | IB1088DMR | 1 |
|  |  | short | | courte | | kurz | corta |  | 2 |
|  |  | medium | | moyenne | | mittel | media | HA89, T0954LM | 3 |
|  |  | long | | longue | | lang | larga |  | 4 |
|  |  | very long | | très longue | | sehr lang | muy larga | U0881BG | 5 |
| **25.** |  | **QN** | **VG** |  |  | **63-65** | | | |
|  |  | |  | | --- | | **Bract: intensity of green color of outer side** | | | |  | | --- | | **Bractée : intensité de la couleur verte de la face externe** | | | |  | | --- | | **Hüllblatt: Intensität der Grünfärbung der Außenseite** | | |  | | --- | | **Bráctea: intensidad del color verde de la cara externa** | |  |  |
|  |  | light | | claire | | hell | clara | T0243HG | 1 |
|  |  | medium | | moyenne | | mittel | media | T0954LM | 2 |
|  |  | dark | | foncée | | dunkel | oscura | RT8711 | 3 |
| **26.** |  | **QN** | **VG** |  |  | **69-73** | | | |
|  |  | |  | | --- | | **Bract: attitude in relation to head** | | | |  | | --- | | **Bractée : port par rapport au capitule** | | | |  | | --- | | **Hüllblatt: Haltung im Verhältnis zum Korb** | | |  | | --- | | **Bráctea: porte en relación con n el capítulo** | |  |  |
|  |  | not adpressed or very slightly adpressed | | non apprimé ou très faiblement apprimé | | nicht anliegend oder sehr leicht anliegend | no adpreso o muy ligeramente adpreso | HA89, RT0976 | 1 |
|  |  | slightly adpressed | | légèrement apprimé | | leicht anliegend | ligeramente adpreso | F7AW1MOA | 2 |
|  |  | strongly adpressed | | fortement apprimé | | stark anliegend | fuertemente adpreso | RT9513 | 3 |
| **27.** | **(\*)** | **QN** | **MS** |  |  | **69-73** | | | |
|  |  | |  | | --- | | **Only inbred lines: Plant: natural height** | | | |  | | --- | | **Seulement pour les lignées : Plante : hauteur naturelle** | | | |  | | --- | | **Nur Inzuchtlinien: Pflanze: natürliche Höhe** | | |  | | --- | | **Sólo variedades endógamas: Planta: altura natural** | |  |  |
|  |  | very short | | très basse | | sehr niedrig | muy baja | FR810RM1 | 1 |
|  |  | very short to short | | très basse à basse | | sehr niedrig bis niedrig | muy baja a baja |  | 2 |
|  |  | short | | basse | | niedrig | baja | OB724 | 3 |
|  |  | short to medium | | basse à moyenne | | niedrig bis mittel | baja a media |  | 4 |
|  |  | medium | | moyenne | | mittel | media | U0881BG | 5 |
|  |  | medium to tall | | moyenne à haute | | mittel bis hoch | media a alta |  | 6 |
|  |  | tall | | haute | | hoch | alta | R6ST2MI | 7 |
|  |  | tall to very tall | | haute à très haute | | hoch bis sehr hoch | alta a muy alta |  | 8 |
|  |  | very tall | | très haute | | sehr hoch | muy alta | 31G03 | 9 |
| **28.** | **(\*)** | **QN** | **MS** |  |  | **69-73** | | | |
|  |  | |  | | --- | | **Only hybrids and open-pollinated varieties: Plant: natural height** | | | |  | | --- | | **Seulement pour les hybrides et les variétés à fécondation libre : Plante : hauteur naturelle** | | | |  | | --- | | **Nur Hybriden und freiabblühende Sorten: Pflanze: natürliche Höhe** | | |  | | --- | | **Sólo híbridos y variedades de polinización libre: Planta: altura natural** | |  |  |
|  |  | very short | | très basse | | sehr niedrig | muy baja | Antonil | 1 |
|  |  | very short to short | | très basse à basse | | sehr niedrig bis niedrig | muy baja a baja |  | 2 |
|  |  | short | | basse | | niedrig | baja | GK Milia | 3 |
|  |  | short to medium | | basse à moyenne | | niedrig bis mittel | baja a media |  | 4 |
|  |  | medium | | moyenne | | mittel | media | Sumiko | 5 |
|  |  | medium to tall | | moyenne à haute | | mittel bis hoch | media a alta |  | 6 |
|  |  | tall | | haute | | hoch | alta | Marley | 7 |
|  |  | tall to very tall | | haute à très haute | | hoch bis sehr hoch | alta a muy alta |  | 8 |
|  |  | very tall | | très haute | | sehr hoch | muy alta | Kisvárdai | 9 |
| **29.** | **(\*)** | **QL** | **VG** |  |  | **69-89** | | | |
|  |  | |  | | --- | | **Plant: branching** | | | |  | | --- | | **Plante : ramification** | | | |  | | --- | | **Pflanze: Verzweigung** | | |  | | --- | | **Planta: ramificación** | |  |  |
|  |  | absent | | absente | | fehlend | ausente | HA89, OB724 | 1 |
|  |  | present | | présente | | vorhanden | presente | RHA274, T0954LM | 9 |
| **30.** | **(\*)** | **PQ** | **VG** | **(+)** |  | **69-89** | | | |
|  |  | |  | | --- | | **Only varieties with Plant: branching: present: Plant: position of branching** | | | |  | | --- | | **Seulement les variétés avec Plante : ramification : présente : Plante : position de la ramification** | | | |  | | --- | | **Nur Sorten mit Pflanze: Verzweigung: vorhanden: Pflanze: Position der Verzweigung** | | |  | | --- | | **Solo variedades con Planta: ramificación: presente: Planta: posición de la ramificación** | |  |  |
|  |  | only basal | | uniquement basale | | nur basal | sólo basal |  | 1 |
|  |  | predominantly basal | | prédominance basale | | überwiegend basal | predominantement basal |  | 2 |
|  |  | throughout | | partout | | überall | total | H11050R | 3 |
|  |  | predominantly apical | | prédominance apicale | | überwiegend apikal | predominantement apical | RHA274, T0954LM | 4 |
|  |  | only apical | | uniquement apicale | | nur apikal | sólo apical | TRC2342 | 5 |
| **31.** |  | **QN** | **VG** |  |  | **69-89** | | | |
|  |  | |  | | --- | | **Only varieties with Plant: branching: present: Plant: position of highest lateral head to central head** | | | |  | | --- | | **Seulement les variétés avec Plante : ramification : présente : Plante : position du capitule latéral le plus haut par rapport au capitule central** | | | |  | | --- | | **Nur Sorten mit Pflanze: Verzweigung: vorhanden: Pflanze: Position des höchsten Seitenkorbes zum Hauptkorb** | | |  | | --- | | **Solo variedades con Planta: ramificación: presente: Planta: posición natural del capítulo lateral más alto, en relación con el capítulo central** | |  |  |
|  |  | below | | au-dessous | | unterhalb | debajo | PH5004R | 1 |
|  |  | same level | | au même niveau | | gleiche Höhe | al mismo nivel | T0954LM | 2 |
|  |  | above | | au-dessus | | oberhalb | encima | 99D40R | 3 |
| **32.** | **(\*)** | **QN** | **VG** | **(+)** |  | **80-89** | | | |
|  |  | |  | | --- | | **Stem: attitude** | | | |  | | --- | | **Tige : port** | | | |  | | --- | | **Stängel: Haltung** | | |  | | --- | | **Tallo: porte** | |  |  |
|  |  | straight | | droit | | gerade | recto | U0881BG | 1 |
|  |  | slightly curved | | légèrement arqué | | leicht gebogen | ligeramente arqueado |  | 2 |
|  |  | strongly curved | | fortement arqué | | stark gebogen | fuertemente arqueado | F7EW2MIA | 3 |
| **33.** | **(\*)** | **QN** | **VG** | **(+)** |  | **80-89** | | | |
|  |  | |  | | --- | | **Head: attitude** | | | |  | | --- | | **Capitule : port** | | | |  | | --- | | **Kopf: Haltung** | | |  | | --- | | **Capítulo: porte** | |  |  |
|  |  | horizontal | | horizontal | | waagerecht | horizontal | RT8711 | 1 |
|  |  | inclined | | incliné | | geneigt | inclinado |  | 2 |
|  |  | vertical | | vertical | | vertikal | vertical | RT0976 | 3 |
|  |  | half-turned down | | demi-renversé | | halbüberhängend | semiinvertido | U0881BG | 4 |
|  |  | turned down | | renversé | | überhängend | invertido | F5DN3MA | 5 |
|  |  | over turned | | retourné | | zurückgebogen | retorcido |  | 6 |
| **34.** | **(\*)** | **QN** | **MS/VG** | **(+)** |  | **80-89** | | | |
|  |  | |  | | --- | | **Head: diameter** | | | |  | | --- | | **Capitule : diamètre** | | | |  | | --- | | **Korb: Durchmesser** | | |  | | --- | | **Capítulo: diámetro** | |  |  |
|  |  | very small | | très petit | | sehr klein | muy pequeño |  | 1 |
|  |  | very small to small | | très petit à petit | | sehr klein bis klein | muy pequeño a pequeño |  | 2 |
|  |  | small | | petit | | klein | pequeño | RT0976 | 3 |
|  |  | small to medium | | petit à moyen | | klein bis mittel | pequeño a medio |  | 4 |
|  |  | medium | | moyen | | mittel | medio | BT0835, HA89 | 5 |
|  |  | medium to large | | moyen à grand | | mittel bis groß | medio a grande |  | 6 |
|  |  | large | | grand | | groß | grande | F5DN3MA | 7 |
|  |  | large to very large | | grand à très grand | | groß bis sehr groß | grande a muy grande |  | 8 |
|  |  | very large | | très grand | | sehr groß | muy grande |  | 9 |
| **35.** | **(\*)** | **PQ** | **VG** | **(+)** |  | **85-87** | | | |
|  |  | |  | | --- | | **Head: shape of seed side** | | | |  | | --- | | **Capitule : forme de la face portant les semences** | | | |  | | --- | | **Korb: Form der Kornseite** | | |  | | --- | | **Capítulo: forma de la parte de la semilla** | |  |  |
|  |  | strongly concave | | fortement concave | | stark konkav | fuertemente cóncava |  | 1 |
|  |  | weakly concave | | faiblement concave | | schwach konkav | débilmente cóncava | R5PG6MJ | 2 |
|  |  | flat | | plate | | gerade | plana | RT8711 | 3 |
|  |  | weakly convex | | faiblement convexe | | schwach konvex | débilmente convexa | HA89, R6ST2MI | 4 |
|  |  | strongly convex | | fortement convexe | | stark konvex | fuertemente convexa | T0916LG | 5 |
|  |  | deformed | | difforme | | verformt | deformada | TRC3398R | 6 |
| **36.** |  | **QN** | **MS/VG** |  |  | **99** | | | |
|  |  | |  | | --- | | **Seed: size** | | | |  | | --- | | **Graine : taille** | | | |  | | --- | | **Korn: Größe** | | |  | | --- | | **Semilla: tamaño** | |  |  |
|  |  | very small | | très petite | | sehr klein | muy pequeño | PHA283 | 1 |
|  |  | very small to small | | très petite à petite | | sehr klein bis klein | muy pequeño a pequeño |  | 2 |
|  |  | small | | petite | | klein | pequeño | TRC2342 | 3 |
|  |  | small to medium | | petite à moyenne | | klein bis mittel | pequeño a medio |  | 4 |
|  |  | medium | | moyenne | | mittel | medio | HA89, OB724 | 5 |
|  |  | medium to large | | moyenne à grande | | mittel bis groß | medio a grande |  | 6 |
|  |  | large | | grande | | groß | grande | FT2603, Kisvárdai | 7 |
|  |  | large to very large | | grande à très grande | | groß bis sehr groß | grande a muy grande |  | 8 |
|  |  | very large | | très grande | | sehr groß | muy grande |  | 9 |
| **37.** | **(\*)** | **PQ** | **VG** | **(+)** |  | **99** | | | |
|  |  | |  | | --- | | **Seed: shape** | | | |  | | --- | | **Graine : forme** | | | |  | | --- | | **Korn: Form** | | |  | | --- | | **Semilla: forma** | |  |  |
|  |  | elongated | | allongée | | langezogen | alargada | BT0835 | 1 |
|  |  | narrow ovoid | | ovoïde étroite | | schmal eiförmig | ovoide estrecha | H11050R | 2 |
|  |  | broad ovoid | | ovoïde large | | breit eiförmig | ovoide ancha | F7AW1MOA, HA89 | 3 |
|  |  | rounded | | arrondie | | abgerundet | redondeada |  | 4 |
| **38.** |  | **QN** | **MS/VG** |  |  | **99** | | | |
|  |  | |  | | --- | | **Seed: thickness relative to width** | | | |  | | --- | | **Graine : épaisseur par rapport à la largeur** | | | |  | | --- | | **Korn: Dicke im Verhältnis zur Breite** | | |  | | --- | | **Semilla: grosor con relación a la anchura** | |  |  |
|  |  | very thin | | très mince | | sehr dünn | muy delgado | RHA801 | 1 |
|  |  | thin | | mince | | dünn | delgado |  | 2 |
|  |  | medium | | moyenne | | mittel | medio | F7AW1MOA, FR83322 | 3 |
|  |  | thick | | épaisse | | dick | grueso | 85C11R, F7AX2MA | 4 |
|  |  | very thick | | très épaisse | | sehr dick | muy grueso |  | 5 |
| **39.** | **(\*)** | **PQ** | **VG** | **(+)** |  | **99** | | | |
|  |  | |  | | --- | | **Seed: color** | | | |  | | --- | | **Graine : couleur** | | | |  | | --- | | **Korn: Farbe** | | |  | | --- | | **Semilla: color** | |  |  |
|  |  | white | | blanc | | weiß | blanco | Labud | 1 |
|  |  | purple | | pourpre | | purpurn | púrpura |  | 2 |
|  |  | light brown | | brun clair | | hellbraun | marrón claro | IR79DMR | 3 |
|  |  | medium brown | | brun moyen | | mittelbraun | marrón medio | H11050R | 4 |
|  |  | dark brown | | brun foncé | | dunkelbraun | marrón oscuro | B0644LM | 5 |
|  |  | light grey | | gris clair | | hellgrau | gris claro | RW666IMI | 6 |
|  |  | medium grey | | gris moyen | | mittelgrau | gris medio | RT9513 | 7 |
|  |  | dark grey | | gris foncé | | dunkelgrau | gris oscuro |  | 8 |
|  |  | black | | noir | | schwarz | negro | HA89, T0954LM | 9 |
| **40.** | **(\*)** | **QN** | **VG** | **(+)** |  | **99** | | | |
|  |  | |  | | --- | | **Seed: stripes on margin** | | | |  | | --- | | **Graine : stries sur le bord** | | | |  | | --- | | **Korn: Streifen am Rand** | | |  | | --- | | **Semilla: rayas en el borde** | |  |  |
|  |  | none or very weak | | aucunes ou très faibles | | keine oder sehr schwach | ausentes o muy débiles | T0954LM | 1 |
|  |  | weak | | faibles | | schwach | débiles | OB724 | 2 |
|  |  | strong | | fortes | | stark | fuertes | HA89, U0881BG | 3 |
| **41.** | **(\*)** | **QN** | **VG** | **(+)** |  | **99** | | | |
|  |  | |  | | --- | | **Seed: stripes between margins** | | | |  | | --- | | **Graine : stries entre les bords** | | | |  | | --- | | **Korn: Streifen zwischen den Rändern** | | |  | | --- | | **Semilla: rayas entre los bordes** | |  |  |
|  |  | none or very weak | | aucunes ou très faibles | | keine oder sehr schwach | ausentes o muy débiles | T0954LM | 1 |
|  |  | weak | | faibles | | schwach | débiles | LGR27 | 2 |
|  |  | strong | | fortes | | stark | fuertes | HA89, U0881BG | 3 |
| **42.** | **(\*)** | **PQ** | **VG** |  |  | **99** | | | |
|  |  | |  | | --- | | **Seed: color of stripes** | | | |  | | --- | | **Graine : couleur des stries** | | | |  | | --- | | **Korn: Farbe der Streifen** | | |  | | --- | | **Semilla: color de las rayas** | |  |  |
|  |  | white | | blanc | | weiß | blanco | U0881BG | 1 |
|  |  | brown | | brun | | braun | marrón | F1164LM | 2 |
|  |  | grey | | gris | | grau | gris | 99D40R | 3 |
|  |  | black | | noir | | schwarz | negro |  | 4 |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  | | --- | --- | --- | --- | | 8. | Explanations on the Table of Characteristics | | | |  | | | | | *8.1* | *Explanations covering several characteristics* | | | |  | | | | |  | |  | | --- | | Unless otherwise indicated, observations should be made on the main stem. | | | | |  |  |  |  | |  | Characteristics containing the following key in the Table of Characteristics should be examined as indicated below: | | | |  | | | | | |  | | --- | | (a) | | |  | | --- | | Observations should be made on fully developed leaves on the upper third of the plant. | | | | |  |  |  |  | |
| |  |  |  | | --- | --- | --- | | |  | | --- | | *8.2* | | *Explanations for individual characteristics* | |  | | | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Ad. 4: Leaf: serration     |  |  |  |  |  | | --- | --- | --- | --- | --- | | wordml://76.png | wordml://77.png | wordml://78.png | wordml://79.png | wordml://80.png | | 1 | 3 | 5 | 7 | 9 | | isolated or very fine | fine | medium | coarse | very coarse | | | | | |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Ad. 5: Leaf: profile in cross-section   |  |  | | --- | --- | | Cross-section: | wordml://81.png |  |  |  |  | | --- | --- | --- | | wordml://82.png | wordml://83.png | wordml://84.png | | 1 | 3 | 5 | | strongly concave | flat | strongly convex | | | | | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Ad. 6: Leaf: shape  Observations should be made on the distal part of the leaf.   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | | 1 | 2 | 3 | 4 | | elliptic | very narrow triangular | narrow triangular | medium triangular |  |  |  |  | | --- | --- | --- | |  |  |  | | 5 | 6 | 7 | | broad triangular | triangular to rounded | rounded | | | | |
| |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Ad. 7: Leaf: lobes   |  |  |  |  |  | | --- | --- | --- | --- | --- | | wordml://85.png | wordml://86.png | wordml://87.png | wordml://88.png | wordml://89.png | | 1 | 3 | 5 | 7 | 9 | | absent or very small | small | medium | large | very large | | | | |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Ad. 8: Leaf: parenchyma at base of lateral veins   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  |  | | --- | --- | --- | | wordml://90.png | wordml://91.png | wordml://92.png | | 1 | 2 | 3 | | none or very weak | weak | strong | | | | | |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Ad. 9: Leaf: angle of lowest lateral veins     |  |  |  | | --- | --- | --- | | wordml://93.png | wordml://94.png | wordml://95.png | | 1 | 2 | 3 | | acute | right angle or nearly right angle | obtuse | | | |
| |  |  | | --- | --- | | |  | | --- | | Ad. 11: Time of beginning of flowering  Time of flowering is reached when 50% of the plants have at least one extended ray floret. | | | |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Ad. 12: Ray floret: attitude of base in relation to head     |  |  | | --- | --- | | wordml://96.png | wordml://97.png | | 1 | 3 | | erect | horizontal | | | | |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Ad. 13: Ray floret: profile     |  |  |  |  | | --- | --- | --- | --- | | wordml://98.png | wordml://99.png | wordml://100.png | wordml://101.png | | 1 | 2 | 3 | 4 | | flat | rolled | twisted | strongly recurved | | | | |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Ad. 16: Ray floret: width in relation to length     |  |  |  |  | | --- | --- | --- | --- | | wordml://102.png | wordml://103.png | wordml://104.png | wordml://105.png | | 1 | 2 | 3 | 4 | | very narrow | narrow | broad | very broad | | | | |  | | --- | | Ad. 17: Ray floret: color  The ray floret color is the color with the largest surface area. In cases where the areas of the color are too similar to reliably decide which color has the largest area, the darker color is to be observed. | | |

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| |  |  | | --- | --- | | |  | | --- | | Ad. 18: Disc floret: anthocyanin coloration of pappus  Observations should be made on the inner third of the disc.    Pappus  Ad. 20: Disc floret: anthocyanin coloration of anthers  Observation should be made on the stigma just after the pollen appears at the top of the anthers. | | | |  | | --- | | Ad. 21: Disc floret: anthocyanin coloration of stigma  See Ad. 20 | | | |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Ad. 23: Bract: shape  To be observed excluding the differentiated tip.     |  |  |  | | --- | --- | --- | | wordml://106.png | wordml://107.png | wordml://108.png | | 1 | 2 | 3 | | narrow acute | broad acute | rounded | | | | |  |  |  | | --- | --- | --- | | Ad. 24: Bract: length of tip  Tip begins where the direction of curving changes.   |  |  | | --- | --- | |  |  | | | |

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| |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Ad. 30: Only varieties with Plant: branching: present: Plant: position of branching     |  |  |  |  |  | | --- | --- | --- | --- | --- | | wordml://110.png | wordml://111.png | wordml://112.png | wordml://113.png | wordml://114.png | | 1 | 2 | 3 | 4 | 5 | | only basal | predominantly basal | throughout | predominantly apical | only apical | | | | |  | | --- | | Ad. 32: Stem: attitude  Observations should be made on the upper third of the stem below the head. | | | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Ad. 33: Head: attitude   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | wordml://115.png | wordml://116.png | wordml://117.png | wordml://118.png | wordml://119.png | wordml://120.png | | 1 | 2 | 3 | 4 | 5 | 6 | | horizontal | inclined | vertical | half-turned down | turned down | over turned |     Ad. 34: Head: diameter  In the case of branching varieties, observations should be made on the central head. | | | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Ad. 35: Head: shape of seed side     |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | wordml://121.png | wordml://122.png | wordml://123.png | wordml://124.png | wordml://125.png | wordml://126.png | | 1 | 2 | 3 | 4 | 5 | 6 | | strongly concave | weakly concave | flat | weakly convex | strongly convex | deformed | | | |

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| |  |  | | --- | --- | |  | | | |  | | --- | | *8.3* | | |  | | --- | | *Growth stage of Helianthus annuus L. adopted to the BBCH (Meier U., 1997) scale applicable to individual plant*  Code    Description  **Principal growth stage 0: Germination**  00        Dry seed (achene)  01        Beginning of seed imbibition  03        Seed imbibition complete  05        Radicle emerged from seed  06        Radicle elongated, root hairs developing  07        Hypocotyl with cotyledons emerged from seed  08        Hypocotyl with cotyledons growing towards soil surface  09        Emergence: cotyledons emerge through soil surface  **Principal growth stage 1: Leaf development**1  10        Cotyledons completely unfolded  12        2 leaves (first pair) unfolded  14        4 leaves (second pair) unfolded  15        5 leaves unfolded  16        6 leaves unfolded  17        7 leaves unfolded  18        8 leaves unfolded  19        9 or more leaves unfolded  1 (Stem elongation may occur earlier than stage 19; in this case continue with the principal stage 3)  **Principal growth stage 3: Stem elongation**  30        Beginning of stem elongation  31        1 visibly extended internode  32        2 visibly extended internodes  33        3 visibly extended internodes  3 .        Stages continuous till . . .  39        9 or more visibly extended internodes  **Principal growth stage 5: Inflorescence emergence**  51        Inflorescence just visible between youngest leaves  53        Inflorescence separating from youngest leaves, bracts distinguishable from foliage leaves  55        Inflorescence separated from youngest foliage leaf  57        Inflorescence clearly separated from foliage leaves  59        Ray florets visible between the bracts; inflorescence still closed  **Principal growth stage 6: Flowering**  61        Beginning of flowering: ray florets extended, disc florets visible in outer third of inflorescence  63        Disc florets in outer third of inflorescence in bloom (stamens and stigma visible)  65        Full flowering: disc florets in middle third of inflorescence in bloom (stamens and stigma visible)  67        Flowering declining: disc florets in inner third of inflorescence in bloom (stamens and stigma visible)  69        End of flowering: most disc florets have finished flowering, ray florets dry or fallen  **Principal growth stage 7: Development of fruit**  71        Seeds on outer edge of the inflorescence are grey and have reached final size  73        Seeds on outer third of the inflorescence are grey and have reached final size  75        Seeds on middle third of the inflorescence are grey and have reached final size  79        Seeds on inner third of the inflorescence are grey and have reached final size  **Principal growth stage 8: Ripening**  80        Beginning of ripening: seeds on outer third of anthocarp black and hard. Back of anthocarp still green  81        Seeds on outer third of anthocarp dark and hard. Back ofanthocarp still green  83        Dark of anthocarp yellowish-green, bracts still green. Seeds about 50% dry matter  85        Seeds on middle third of anthocarp dark and hard. Back of anthocarp yellow, bracts brown edged. Seeds about 60% dry matter  87        Physiological ripeness: back of the anthocarp yellow. Bracts marbled brown. Seeds about 75– 80% dry matter  89        Fully ripe: seeds on inner third of anthocarp dark and hard. Back of anthocarp brown. Bracts brown. Seeds about 85% dry matter  **Principal growth stage 9:**  92        Over ripe, seeds over 90% dry matter  97        Plant dead and dry  99        Harvested product | | |

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| |  |  | | --- | --- | | 10. | Technical Questionnaire | |
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| |  |  | | --- | --- | |  | Application date: (not to be filled in by the applicant) | | TECHNICAL QUESTIONNAIRE to be completed in connection with an application for plant breeders' rights | | | In the case of hybrid varieties which are the subject of an application for plant breeders' rights, and where the parent lines are to be submitted as a part of the examination of the hybrid variety, this Technical Questionnaire should be completed for each of the parent lines, in addition to being completed for the hybrid variety. | | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  |  | | 1. | Subject of the Technical Questionnaire | | | | |  |  |  |  |  | |  | |  | | --- | | 1.1 | | Botanical name | |  | | --- | | *Helianthus annuus* L. | | |  | | --- | |  | | |  |  |  |  |  | |  | |  | | --- | | 1.2 | | Common name | |  | | --- | | Sunflower | |  | |  |  |  | |  | | --- | |  | |  | |  |  |  |  |  | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  |  | | 2. | Applicant | | | | |  |  |  |  |  | |  | Name | |  |  | |  |  |  |  |  | |  | Address | |  |  | |  |  |  |  | |  |  |  |  | |  |  |  |  |  | |  | Telephone No. | |  |  | |  |  |  |  |  | |  | Fax No. | |  |  | |  |  |  |  |  | |  | E-mail address | |  |  | |  |  |  |  |  | |  | Breeder (if different from | |  |  | |  | applicant) | |  |  | |  |  |  |  |  | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  |  | | 3. | Proposed denomination and breeder's reference | | | | |  |  |  |  |  | |  | Proposed denomination | |  |  | |  | (if available) | |  |  | |  |  |  |  |  | |  | Breeder's reference | |  |  | |  |  |  |  |  | |

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| |  |  |  |  |  | | --- | --- | --- | --- | --- | | TECHNICAL QUESTIONNAIRE | | | Page {x} of {y} | Reference Number: | |  | | | | | | |  | | --- | | #4. | | Information on the breeding scheme and propagation of the variety | | | | |  |  |  | | | |  | 4.1 | Breeding scheme | | | |  | Variety resulting from: | | | | |  | |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  | | --- | | 4.1.1 | | |  | | --- | | Crossing | |  | | |  | | --- | | (a) | | |  | | --- | | controlled cross | | [ ] | |  | |  | | --- | | (please state parent variety)  (…………………..……………..…)                          x        (……………..…………………..…)  female parent                                                                     male parent | | | | |  | | --- | | (b) | | |  | | --- | | partially known cross | | [ ] | |  | |  | | --- | | (please state known parent variety(ies))  (…………………..……………..…)                          x        (……………..…………………..…)  female parent                                                                     male parent | | | | |  | | --- | | (c) | | |  | | --- | | unknown cross | | [ ] | |  |  | | | |  | | --- | | 4.1.2 | | |  | | --- | | Mutation  (please state parent variety) | | [ ] | |  |  | | |  |  | | | |  | | --- | | 4.1.3 | | |  | | --- | | Discovery and development  (please state where and when discovered and how developed) | | [ ] | |  |  | | |  |  | | | |  | | --- | | 4.1.4 | | Other (Please provide details) | [ ] | |  |  | | |  |  | | | | | | |

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| |  |  |  | | --- | --- | --- | |  |  |  | |  | 4.2 | Method of propagating the variety | |  | |  |  |  | | --- | --- | --- | | |  | | --- | | 4.2.1 | | |  | | --- | | Seed-propagated varieties | |  | | |  | | --- | | (a) | | |  | | --- | | Inbred line | | [ ] | | |  | | --- | | (i) | | |  | | --- | | Male sterile line | | [ ] | | |  | | --- | | (ii) | | |  | | --- | | Male fertile line | | [ ] | | |  | | --- | | (b) | | |  | | --- | | Hybrid | | [ ] | | |  | | --- | | (i) | | |  | | --- | | Male sterile hybrid | | [ ] | | |  | | --- | | (ii) | | |  | | --- | | Male fertile single hybrid | | [ ] | | |  | | --- | | (iii) | | |  | | --- | | Three-way hybrid | | [ ] | | |  | | --- | | (c) | | Cross-pollination | [ ] | | |  | | --- | | (d) | | |  | | --- | | Other (please provide details) | | [ ] | |  |  |  | |  |  |  | |  |  |  | | |  | | --- | | 4.2.2 | | Other (Please provide details) | [ ] | |  |  |  | |  |  |  | |  |  |  | | | |

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| |  |  |  |  | | --- | --- | --- | --- | | 5. | Characteristics of the variety to be indicated (the number in brackets refers to the corresponding characteristic in Test Guidelines; please mark the note which best corresponds). | | | |  |  |  |  | |

|  | Characteristics | Example Varieties | Note |
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| |  | | --- | | **5.1** |  |  | | --- | | **(2)** | | |  | | --- | | **Leaf: intensity of green color** | |  |  |
|  | |  | | --- | | very light | | |  | | --- | | F5DN3MA, T0243HG | | |  | | --- | | 1 [   ] | |
|  | |  | | --- | | light | | |  | | --- | |  | | |  | | --- | | 2 [   ] | |
|  | |  | | --- | | medium | | |  | | --- | | H11050R | | |  | | --- | | 3 [   ] | |
|  | |  | | --- | | dark | | |  | | --- | |  | | |  | | --- | | 4 [   ] | |
|  | |  | | --- | | very dark | | |  | | --- | | 13013 | | |  | | --- | | 5 [   ] | |
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| |  | | --- | | **5.2** |  |  | | --- | | **(3)** | | |  | | --- | | **Leaf: blistering** | |  |  |
|  | |  | | --- | | absent or very weak | | |  | | --- | | F5DN3MA | | |  | | --- | | 1 [   ] | |
|  | |  | | --- | | very weak to weak | | |  | | --- | |  | | |  | | --- | | 2 [   ] | |
|  | |  | | --- | | weak | | |  | | --- | | F7AX2JA, IR79DMR | | |  | | --- | | 3 [   ] | |
|  | |  | | --- | | weak to medium | | |  | | --- | |  | | |  | | --- | | 4 [   ] | |
|  | |  | | --- | | medium | | |  | | --- | | HA89, IB1088DMR | | |  | | --- | | 5 [   ] | |
|  | |  | | --- | | medium to strong | | |  | | --- | |  | | |  | | --- | | 6 [   ] | |
|  | |  | | --- | | strong | | |  | | --- | | TRC2342 | | |  | | --- | | 7 [   ] | |
|  | |  | | --- | | strong to very strong | | |  | | --- | |  | | |  | | --- | | 8 [   ] | |
|  | |  | | --- | | very strong | | |  | | --- | |  | | |  | | --- | | 9 [   ] | |
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| |  | | --- | | **5.3** |  |  | | --- | | **(11)** | | |  | | --- | | **Time of beginning of flowering** | |  |  |
|  | |  | | --- | | very early | | |  | | --- | | PHA283 | | |  | | --- | | 1 [   ] | |
|  | |  | | --- | | very early to early | | |  | | --- | |  | | |  | | --- | | 2 [   ] | |
|  | |  | | --- | | early | | |  | | --- | | T0860LM | | |  | | --- | | 3 [   ] | |
|  | |  | | --- | | early to medium | | |  | | --- | |  | | |  | | --- | | 4 [   ] | |
|  | |  | | --- | | medium | | |  | | --- | | H11050R, RHA274 | | |  | | --- | | 5 [   ] | |
|  | |  | | --- | | medium to late | | |  | | --- | |  | | |  | | --- | | 6 [   ] | |
|  | |  | | --- | | late | | |  | | --- | | RT7710 | | |  | | --- | | 7 [   ] | |
|  | |  | | --- | | late to very late | | |  | | --- | |  | | |  | | --- | | 8 [   ] | |
|  | |  | | --- | | very late | | |  | | --- | | Kisvárdai, LGR27 | | |  | | --- | | 9 [   ] | |
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| |  | | --- | | **5.4** |  |  | | --- | | **(17)** | | |  | | --- | | **Ray floret: color** | |  |  |
|  | |  | | --- | | yellowish white | | |  | | --- | | RHA381 | | |  | | --- | | 1 [   ] | |
|  | |  | | --- | | light yellow | | |  | | --- | | F7AW1MOA | | |  | | --- | | 2 [   ] | |
|  | |  | | --- | | medium yellow | | |  | | --- | | RT7710 | | |  | | --- | | 3 [   ] | |
|  | |  | | --- | | orange yellow | | |  | | --- | | U0881BG | | |  | | --- | | 4 [   ] | |
|  | |  | | --- | | orange | | |  | | --- | | OB724, P211R | | |  | | --- | | 5 [   ] | |
|  | |  | | --- | | purple | | |  | | --- | |  | | |  | | --- | | 6 [   ] | |
|  | |  | | --- | | reddish brown | | |  | | --- | |  | | |  | | --- | | 7 [   ] | |
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| |  | | --- | | **5.5** |  |  | | --- | | **(22)** | | |  | | --- | | **Disc floret: production of pollen** | |  |  |
|  | |  | | --- | | absent | | |  | | --- | | F7AW1MOA, HA89 | | |  | | --- | | 1 [   ] | |
|  | |  | | --- | | present | | |  | | --- | | IR79DMR, RHA274 | | |  | | --- | | 9 [   ] | |
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| |  | | --- | | **5.6** |  |  | | --- | | **(27)** | | |  | | --- | | **Only inbred lines: Plant: natural height** | |  |  |
|  | |  | | --- | | very short | | |  | | --- | | FR810RM1 | | |  | | --- | | 1 [   ] | |
|  | |  | | --- | | very short to short | | |  | | --- | |  | | |  | | --- | | 2 [   ] | |
|  | |  | | --- | | short | | |  | | --- | | OB724 | | |  | | --- | | 3 [   ] | |
|  | |  | | --- | | short to medium | | |  | | --- | |  | | |  | | --- | | 4 [   ] | |
|  | |  | | --- | | medium | | |  | | --- | | U0881BG | | |  | | --- | | 5 [   ] | |
|  | |  | | --- | | medium to tall | | |  | | --- | |  | | |  | | --- | | 6 [   ] | |
|  | |  | | --- | | tall | | |  | | --- | | R6ST2MI | | |  | | --- | | 7 [   ] | |
|  | |  | | --- | | tall to very tall | | |  | | --- | |  | | |  | | --- | | 8 [   ] | |
|  | |  | | --- | | very tall | | |  | | --- | | 31G03 | | |  | | --- | | 9 [   ] | |
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| |  | | --- | | **5.7** |  |  | | --- | | **(28)** | | |  | | --- | | **Only hybrids and open-pollinated varieties: Plant: natural height** | |  |  |
|  | |  | | --- | | very short | | |  | | --- | | Antonil | | |  | | --- | | 1 [   ] | |
|  | |  | | --- | | very short to short | | |  | | --- | |  | | |  | | --- | | 2 [   ] | |
|  | |  | | --- | | short | | |  | | --- | | GK Milia | | |  | | --- | | 3 [   ] | |
|  | |  | | --- | | short to medium | | |  | | --- | |  | | |  | | --- | | 4 [   ] | |
|  | |  | | --- | | medium | | |  | | --- | | Sumiko | | |  | | --- | | 5 [   ] | |
|  | |  | | --- | | medium to tall | | |  | | --- | |  | | |  | | --- | | 6 [   ] | |
|  | |  | | --- | | tall | | |  | | --- | | Marley | | |  | | --- | | 7 [   ] | |
|  | |  | | --- | | tall to very tall | | |  | | --- | |  | | |  | | --- | | 8 [   ] | |
|  | |  | | --- | | very tall | | |  | | --- | | Kisvárdai | | |  | | --- | | 9 [   ] | |
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| |  | | --- | | **5.8** |  |  | | --- | | **(29)** | | |  | | --- | | **Plant: branching** | |  |  |
|  | |  | | --- | | absent | | |  | | --- | | HA89, OB724 | | |  | | --- | | 1 [   ] | |
|  | |  | | --- | | present | | |  | | --- | | RHA274, T0954LM | | |  | | --- | | 9 [   ] | |
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| |  | | --- | | **5.9** |  |  | | --- | | **(39)** | | |  | | --- | | **Seed: color** | |  |  |
|  | |  | | --- | | white | | |  | | --- | | Labud | | |  | | --- | | 1 [   ] | |
|  | |  | | --- | | purple | | |  | | --- | |  | | |  | | --- | | 2 [   ] | |
|  | |  | | --- | | light brown | | |  | | --- | | IR79DMR | | |  | | --- | | 3 [   ] | |
|  | |  | | --- | | medium brown | | |  | | --- | | H11050R | | |  | | --- | | 4 [   ] | |
|  | |  | | --- | | dark brown | | |  | | --- | | B0644LM | | |  | | --- | | 5 [   ] | |
|  | |  | | --- | | light grey | | |  | | --- | | RW666IMI | | |  | | --- | | 6 [   ] | |
|  | |  | | --- | | medium grey | | |  | | --- | | RT9513 | | |  | | --- | | 7 [   ] | |
|  | |  | | --- | | dark grey | | |  | | --- | |  | | |  | | --- | | 8 [   ] | |
|  | |  | | --- | | black | | |  | | --- | | HA89, T0954LM | | |  | | --- | | 9 [   ] | |
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| |  | | --- | | **5.10** |  |  | | --- | | **(40)** | | |  | | --- | | **Seed: stripes on margin** | |  |  |
|  | none or very weak | |  | | --- | | T0954LM | | |  | | --- | | 1 [   ] | |
|  | weak | |  | | --- | | OB724 | | |  | | --- | | 2 [   ] | |
|  | strong | |  | | --- | | HA89, U0881BG | | |  | | --- | | 3 [   ] | |
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| |  | | --- | | **5.11** |  |  | | --- | | **(41)** | | |  | | --- | | **Seed: stripes between margins** | |  |  |
|  | none or very weak | |  | | --- | | T0954LM | | |  | | --- | | 1 [   ] | |
|  | weak | |  | | --- | | LGR27 | | |  | | --- | | 2 [   ] | |
|  | strong | |  | | --- | | HA89, U0881BG | | |  | | --- | | 3 [   ] | |
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| |  |  |  | | --- | --- | --- | | TECHNICAL QUESTIONNAIRE | Page {x} of {y} | Reference Number: | |
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| |  |  | | --- | --- | | 6. | Similar varieties and differences from these varieties | | |  | | --- | | *Please use the following table and box for comments to provide information on how your candidate variety differs from the variety (or varieties) which, to the best of your knowledge, is (or are) most similar. This information may help the examination authority to conduct its examination of distinctness in a more efficient way.* | | | | |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | |  | | --- | | Denomination(s) of variety(ies) similar to your candidate variety | | |  | | --- | | Characteristic(s) in which your candidate variety differs from the similar variety(ies) | | |  | | --- | | Describe the expression of the characteristic(s) for the **similar** variety(ies) | | |  | | --- | | Describe the expression of the characteristic(s) for **your** candidate variety | | | | | |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | *Example* | |  | | --- | | *Time of beginning of flowering* | | |  | | --- | | *early* | | |  | | --- | | *late* | | |  |  |  |  | |  |  |  |  | |  |  |  |  | | | |  | Comments: | |

|  |  |  |  |
| --- | --- | --- | --- |
| |  |  |  | | --- | --- | --- | | TECHNICAL QUESTIONNAIRE | Page {x} of {y} | Reference Number: | |
|  |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | |  | | --- | | #7. | | Additional information which may help in the examination of the variety | | | | |  |  |  | | | | 7.1 | In addition to the information provided in sections 5 and 6, are there any additional characteristics which may help to distinguish the variety? | | | | |  | Yes | [ ] | No | [ ] | |  | (If yes, please provide details) | | | | | 7.2 | Are there any special conditions for growing the variety or conducting the examination? | | | | |  | Yes | [ ] | No | [ ] | |  | (If yes, please provide details) | | | | | 7.3 | Other information | | | | | |  | | --- | | (1) Use      (a) oil and cake [ ]      (b) birds consumption [ ]       (c) direct human consumption (hulling type) [ ]       (d) direct human consumption (confectionary) [ ]      (e) other use (please specify) [ ]  (2) Resistance to pests and diseases      (a) Downy mildew (specify the races) [ ]        (b) Broomrape (specify the races) [ ]      (c) other pests or diseases (please specify) [ ]  (3) Oleic acid content        (a) low [ ]      (b) medium [ ]     (c) high [ ]  (4) Tolerance to herbicides      (a) yes (please specify) [ ]      (b) no [ ] | |  | | | | | | |  |  |  |  |  | |

|  |  |  |  |
| --- | --- | --- | --- |
| |  |  |  | | --- | --- | --- | | TECHNICAL QUESTIONNAIRE | Page {x} of {y} | Reference Number: | |
|  |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | 8. | Authorization for release | | | | | |  | (a) | Does the variety require prior authorization for release under legislation concerning the protection of the environment, human and animal health? | | | | |  |  | Yes | [ ] | No | [ ] | |  | (b) | Has such authorization been obtained? | | | | |  |  | Yes | [ ] | No | [ ] | |  | If the answer to (b) is yes, please attach a copy of the authorization. | | | | | |  |  |  |  |  |  | |
| |  |  | | --- | --- | | |  | | --- | | 9. Information on plant material to be examined or submitted for examination | | |  | | 9.1 The expression of a characteristic or several characteristics of a variety may be affected by factors, such as pests and disease, chemical treatment (e.g. growth retardants or pesticides), effects of tissue culture, different rootstocks, scions taken from different growth phases of a tree, etc. | |  | | |  | | --- | | 9.2 The plant material should not have undergone any treatment which would affect the expression of the characteristics of the variety, unless the competent authorities allow or request such treatment. If the plant material has undergone such treatment, full details of the treatment must be given. In this respect, please indicate below, to the best of your knowledge, if the plant material to be examined has been subjected to: | | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | (a) | Microorganisms (e.g. virus, bacteria, phytoplasma) | Yes [ ] | No [ ] |  | |  | (b) | Chemical treatment (e.g. growth retardant, pesticide) | Yes [ ] | No [ ] |  | |  | (c) | Tissue culture | Yes [ ] | No [ ] |  | |  | (d) | Other factors | Yes [ ] | No [ ] |  | |  | Please provide details for where you have indicated “yes”. | | | |  | |  |  | | | |  | | |  | |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | 10. | I hereby declare that, to the best of my knowledge, the information provided in this form is correct: | | | | | |  |  |  |  |  |  | |  |  |  | | |  | |  | Applicant’s name |  | |  |  |  |  |  |  | |  | Signature |  | Date |  |  | |  |  |  | |  |  | |  |  |  |  |  |  | |
|  |

[Annex follows]

ANNEX

Additional Useful Explanations

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Part I

Introduction

The following Annex contains a list of characteristics derived by using electrophoresis and a description of the method to be used. UPOV decided to place these characteristics in an Annex to the Test Guidelines, thereby creating a special category of characteristic, because the majority of the UPOV member States is of the view that it is not possible to establish distinctness solely on the basis of a difference found in a characteristic derived by using electrophoresis. Such characteristics should therefore only be used as a complement to other differences in morphological or physiological characteristics. UPOV reconfirms that these characteristics are considered useful but that they might not be sufficient on their own to establish distinctness. They should not be used as a routine characteristic but at the request or with the agreement of the applicant of the candidate variety.

Part II

Characteristics Derived by Using Electrophoresis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Nr. | Characteristic | States of expression | Example varieties | Note |
| 42 | **Allele expression at locus Me1** | Genotype 2/2 | IB1088DMR | 1 |
|  |  | Genotype 4/4 | SF9074MA | 2 |
|  |  | Genotype 2/4 | Sumiko | 3 |
| 43 | **Allele expression at locus Pgd1** | Genotype 2/2 | IB1088DMR | 1 |
|  |  | Genotype 4/4 | SF9074MA | 2 |
|  |  | Genotype 2/4 | Sumiko | 3 |
| 44 | **Allele expression at locus Pgi2** | Genotype 2/2 | IB1088DMR | 1 |
|  |  | Genotype 4/4 | SF9074MA | 2 |
|  |  | Genotype 2/4 | GK Petrus CLP | 3 |
| 45 | **Allele expression at locus Shdh1** | Genotype 2/2 | IB1088DMR | 1 |
|  |  | Genotype 4/4 |  | 2 |
|  |  | Genotype 2/4 | Marley | 3 |
| 46 | **Allele expression at locus Pgm4** | Genotype 2/2 |  | 1 |
|  |  | Genotype 4/4 | IB1088DMR | 2 |
|  |  | Genotype 2/4 | GK Petrus CLP | 3 |

Part III

Description of the Method to be Used

Description of the SGE Method for the

Analysis of Isoenzymes from *Helianthus annuus L.*

**1.** **Number of seedlings per test:**

* For checking formula:

10 seedlings each of inbred lines

4 seedlings of single hybrids

10 seedlings of three-way hybrids

* For distinctness, uniformity and stability test:

at least 40 seedlings for inbred lines, hybrids and open-pollinated varieties

**2.** **Apparatus and equipment**

Any suitable horizontal electrophoresis system can be used, provided that the gels can be kept at 4° C. A gel thickness of 10 mm is recommended. The power supply used should be capable of delivering constant voltage output.

3. **Chemicals**

All chemicals should be of ‘Analytical Reagent’ grade or better.

3.1 Chemicals for enzyme extraction:

Tris- (hydroxymethyl) aminomethane (Tris)

Hydrochloric acid

β-Mercaptoethanol

3.2 Chemicals for electrophoresis

Bromophenol blue

Citric acid monohydrate

L-Histidine

Starch hydrolysed, for electrophoresis, (Sigma S-4501 or equivalent)

3.3 Chemicals for staining enzymes

95% Ethanol

Ethylenediamine tetra-acetic acid, disodium salt (EDTA Na2)

D-Fructose 6-phosphate, disodium salt

α-D-Glucose 1-phosphate, monohydrate, disodium salt

Glucose 6-phosphate dehydrogenase (Sigma G5885)

Hydrochloric acid (HCl)

Magnesium chloride hexahydrate (MgCl2, 6H2O)

DL-Malic acid, monosodium salt

Dimethylthiazol diphenyl tetrazolium (MTT)

β-Nicotinamide adenine dinucleotide phosphate (NADP)

Nitro-blue tetrazolium (NBT)

6-phosphogluconic acid, trisodium salt dihydrate

Phenazine methosulfate (PMS)

Shikimic acid

Sodium hydroxide (NaOH)

Tris- (hydroxymethyl) aminomethane (Tris)

4. **Solutions**

4.1 Extraction solution: 0.1M Tris HCl (pH 7.2) + 0.2 % 2-mercaptoethanol (v/v).

4.2. Electrophoresis buffers

4.2.1 Buffers for SGE pH 6.5

4.2.1.1 Stock solution: 0.364 M L-histidine-citrate

50.44 g L-histidine

8.34 g Citric acid monohydrate

made up to 1 l with de-ionised water

4.2.1.2 Running buffer: 0.072 M L-histidine-citrate pH 6.5 (Stock solution diluted 1 in 5)

400 ml stock solution (4.2.1.1)

made up to 2 l with de-ionised water

4.2.1.3 Gel buffer: 0.024 M L-histidine-citrate (Stock solution diluted 1 in 15)

80 ml stock solution (4.2.1.1)

made up to 1200 ml with de-ionised water

4.2.2 Buffers for SGE pH 5.7

4.2.2.1 Running buffer: 0.067 M L-histidine-citrate pH 5.7:

20.18 g L-histidine

8.34 g Citric acid monohydrate

made up to 2 l with de-ionised water

4.2.2.2 Gel buffer: 0.011 M L-histidine-citrate (Running buffer diluted 1 in 6):

100 ml running buffer (4.2.2.1) made up to 1200 ml with de-ionised water

4.2.2.3 Bromophenol blue solution:

50 mg bromophenol blue dissolved in 100 ml de-ionised water

4.3 Staining solutions

4.3.1 Stock solutions

4.3.1.1 1 M Tris-HCl pH 7.5

121.1 g Tris, made up to 1 l with de-ionised water and adjusted to pH 7.5 with 50 % HCl

4.3.1.2 1 M Tris-HCl pH 8.5

121.1 g Tris, made up to 1 l with de-ionised water and adjusted to pH 8.5 with 50 % HCl

4.3.1.3 MTT solution

1.0 g MTT made up to 100 ml with de-ionised water

4.3.1.4 NBT solution

1.0 g NBT made up to 100 ml with de-ionised water

4.3.1.5 PMS solution

200 mg PMS made up to 100 ml with de-ionised water

4.3.1.6 MgCl2 solution

10 g Magnesium chloride hexahydrate made up to 100 ml with de-ionised water

4.3.1.7 Sodium malate solution

2.5 g DL-malic acid

made up to 50 ml with de-ionised water and adjusted to pH 8.0 with 1M NaOH.

4.3.2 Staining solutions

4.3.2.1 ME staining solution

100 ml 0.1 M Tris HCl, pH 7.5 (4.3.1.1 diluted 1 in 10)

4 ml Sodium malate solution (4.3.1.7.)

1 ml NBT solution (4.3.1.4.)

1 ml PMS solution (4.3.1.5.)

1,8 ml MgCl2 solution (4.3.1.6.)

17.5 mg NADP

4.3.2.2 PGD + PGI staining solution

100 ml 0.1 M Tris HCl, pH 7.5 (4.3.1.1. diluted 1 in 10)

100 mg D-Fructose 6-phosphate Na2 salt

60 mg 6-Phosphogluconic acid Na3 salt

10 mg NADP

1 ml MTT solution (4.3.1.3.)

1.5 ml PMS solution (4.3.1.5.)

1 ml MgCl2 solution (4.3.1.6.)

40 units of Glucose-6-phosphate dehydrogenase (SIGMA G 5885)

To stain PGI only, do not include 6-phosphogluconic acid.

To stain PGD only, do not include either fructose 6-phosphate disodium salt or glucose 6-phosphate dehydrogenase.

4.3.2.3 ShDH staining solution

100 ml 0.2 M Tris HCl, pH 8.5 (4.3.1.2 diluted 1 in 5)

50 mg shikimic acid

1 ml MTT solution (4.3.1.3)

1.25 ml PMS solution (4.3.1.5)

12 mg NADP

4.3.2.4 PGM staining solution

100 ml 0.1 M Tris HCl, pH 8.5 (4.3.1.2. diluted 1 in 10)

150 mg α-D-Glucose 1-phosphate 1H2O, Na2 salt

150 mg EDTA, Na2

10 mg NADP

1.5 ml MTT solution (4.3.1.3)

1.ml PMS solution (4.3.1.5)

4 ml MgCl2 solution (4.3.1.6)

40 units of Glucose 6-phosphate dehydrogenase

5. **Procedure**

5.1. Enzyme extraction

Seedlings are grown on moistened germination paper, at 25°C, in darkness, for 2 to 3 days. Seed coats are removed and cotyledons are crushed at 4°C, with a pestle in 1.5 ml microtubes containing 300 μl extraction buffer (4.1).

The extracts can be stored at -30°C or at -80°C.

5.2 Preparation of the gel

Prepare the gels the day before migration.

To make two 12.5 % starch gels (18 x 18 x 1 cm) the following is required: 128 g starch are mixed in 1020 ml gel buffer (4.2.1.3 or 4.2.2.2) in a 1000 ml Büchner flask and heated at 78°C. The mixture is degassed with a water jet aspirator for 30 seconds. The gels are poured into gel moulds as described in the user’s manual of the equipment used. The formation of air bubbles should be avoided. The gels are allowed to cool at room temperature for 45 min, then placed in a refrigerator for 1 h. The gels are wrapped with polyethylene film for overnight storage. and cooled to 4°C for 1 h before migration.

5.3 Electrophoresis

5.3.1 Each electrode tank is filled with the appropriate volume of running buffer (4.2.1.2 or 4.2.2.1) pre-cooled to 4°C. The polyethylene film is lifted up and two transversal slits are cut in the gel 3 cm and 4 cm from the edge (cathode side) of the mould.

The 1 cm gel slice is removed and the extracts are loaded as follows:

The enzyme extracts are thawed from 5.1, and absorbed on a filter paper wick (1.5 mm x 20 mm, Whatman N° 3).

The wicks are inserted into the gel, tightly against the first slit.

One wick soaked with bromophenol blue solution (4.2.2.3) (migration dye marker) is placed on each side of the gel.

The gel slice is cautiously replaced. Each gel is covered with polyethylene film.

The two gels, with the extracts on the cathodal side, are placed on the two electrode buffer tanks, in a refrigerated cabinet at 4°C.

The electrophoresis is carried out at 4°C, towards the anode. After 15 min of migration at the first voltage, the wicks are removed and the voltage is increased. Constant voltage should be maintained during each phase.

The electrophoretic conditions are indicated in the following table.

|  |  |  |  |
| --- | --- | --- | --- |
| Buffer systems | Constant voltage | Distance run by  bromophenol blue | Duration of  migration |
| Histidine citrate pH 5.7 | 260 V for 15 min  then 290 V | 13 cm | 5 h |
| Histidine citrate pH 6.5 | 240 V for 15 min  then 280 V | 11 cm | 5 h |

SGE at pH 5.7 should be used for detecting ME, PGD and PGI. The isoenzymes PGM and ShDH should be analysed by SGE pH 6.5.

5.4 Enzyme staining

After switching off the current, the gel is cut horizontally in 1 mm thick slices with a very fine steel wire or a fishing line. The upper slice is discarded. Individual gel slices are stained by incubation at 37°C, in darkness in the following solutions:

for ME: solution 4.3.2.1, incubation time: 15 h

for PGD and PGI: solution 4.3.2.2, incubation time: 1 h

for SHDH: solution 4.3.2.3, incubation time: 1 h

for PGM: solution 4.3.2.4, incubation time: 1/2 h

After staining the gel slices are rinsed in de-ionised water and fixed in 40% ethanol solution. The following procedures for long time storing can be successfully used: e.g. drying of the gels between two cellophane sheets soaked in a 5% glycerol solution, or storing in sealed polyethylene bags.

6. **Recognition of the alleles encoding isoenzymes**

6.1 Recognition of the alleles encoding ME

6.1.1 Genetic interpretation of the zymogrammes

|  |  |  |  |
| --- | --- | --- | --- |
| Enzyme | Quaternary structure | Locus | Alleles |
| Malic enzyme | Tetrameric | Me1 | 2 |
| (ME) |  |  | 4 |

6.1.2 Schematization of the zymogrammes



6.2 Recognition of the alleles encoding PGD

6.2.1 Genetic interpretation of the zymogrammes

|  |  |  |  |
| --- | --- | --- | --- |
| Enzyme | Quaternary structure | Locus | Alleles |
| 6-phosphogluconate dehydrogenase  (PGD) | Dimeric | Pgd1 | 2  4 |

6.2.2 Schematization of the zymogrammes



Two migration zones can be observed; only the slowest migrating bands are polymorphic.

6.3 Recognition of the alleles encoding PGI

6.3.1 Genetic interpretation of the zymogrammes

|  |  |  |  |
| --- | --- | --- | --- |
| Enzyme | Quaternary structure | Locus | Alleles |
| Phosphoglucoisomerase  (PGI) | Dimeric | Pgi2 | 2  4 |

6.3.2 Schematization of the zymogrammes



There are two migration zones; only the slowest migrating bands are scored.

6.4 Recognition of the alleles encoding ShDH

6.4.1 Genetic interpretation of the zymogrammes

|  |  |  |  |
| --- | --- | --- | --- |
| Enzyme | Quaternary structure | Locus | Alleles |
| Shikimate dehydrogenase  (S**h**DH) | Monomeric | Shdh1 | 2  4 |

6.4.2 Schematization of the zymogrammes



6.5 Recognition of the alleles encoding PGM

6.5.1 Genetic interpretation of the zymogrammes

|  |  |  |  |
| --- | --- | --- | --- |
| Enzyme | Quaternary structure | Locus | Alleles |
| Phosphoglucomutase | Monomeric | Pgm4 | 2  4 |

6.5.2 Schematization of the zymogrammes



Several migration zones can be observed; only the fastest zone is polymorphic.

There is another gene which has not been considered. This has been designated Pgm3, encoding an enzyme which comigrates with PGM4 4.

So, the genotypes Pgm4 2/2 and Pgm4 2/4 give a two-band zymogramme. These both genotypes differ only by relative band intensities.

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