DESCRIPTOR LIST FOR
FLAX

Linum usitatissimum L.

Edited by Janka Nôžková

D E S C R I P T O R L I S T F O R

FLAX

Linum usitatissimum L.

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E d i t e d b y J a n k a N ô ž k o v á

Name: DESCRIPTOR LIST FOR FLAX (*LINUM USITATISSIMUM* L.)

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PREFACE

Biodiversity – variety is the basis of life on Earth. It is the most unique attribute of nature, but the least known and valued by man from the view of his further existence. The biodiversity creates the inexhaustible source for development of all human material and spiritual activities; therefore it is the basic part of a sustainable development.

Biodiversity represents also a basis for each species, when new individuals – genotypes - are formed. Many of them become interesting objects of economic utilization.

Genes and gene complexes with phenotypic expressions create for individuals, in interaction with the environment, potential genetic resources in each population, beauty of diversity, but also specific complexity for its evaluation, comparison, scoring and economic utilization. For this reason it was, it is and it will be the interest of every user to search the way and system for description and characterization of genetic resources according to qualitative and quantitative traits.

In recent years, a scoring system is rationally used for characterization of intraspecific diversity. Many collectives create these systems for individual plant species, and they represent an integral systems for evaluation of morphological, biological, biochemical, economic and other traits. The basic part of such scoring system is a descriptor, as the methodology for one trait evaluation.

Each scoring system for plant species consists of tens descriptors, and can seem as a very simple piece of work, which offers very simple way of scoring within individual trait.

The development of descriptors, for evaluation of qualitative and quantitative traits, at first sight is not easy. First of all, it demands the author's knowledge of the variability. In practice it means a patient and tireless study of hundreds genotypes for determination of variability range – variation range for each trait. For this reason the preparation of each descriptor list demands a several years' systematic work.

The illustration of such effort is the List of Descriptors for evaluation of flax genetic resources, which was created by the international team. It was prepared by well known experts from the N.I. Vavilov Institute in Petersburg in Russia, the

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Agritec Ltd. Šumperk in the Czech Republic and the Institute of Biodiversity Conservation and Biosafety (at the The Slovak University of Agriculture in Nitra) in Slovakia. In spite of expert collectives it cannot be claimed that descriptors represent the complete variability of traits within species *Linum usitatissimum* L. It is possible that many researchers, plant breeders, experts from gene banks and other users know also other phenotypic traits expressions. As the authors of this publication we will gladly accept not only critical remarks, but also other recommendations to complete and improve this publication.

Each created list of descriptors represents a high concentration of extensive knowledge, which can be used not only for a genetic resources evaluation and new cultivars breeding, but also for observation of the species economic value. For this reason this publication is suitable for wide public.

Ján Brindza

INTRODUCTION

Flax is one of the oldest cultivated crops with oil and fiber use. Together with wheat and barley it is one of the first crops, which man used for his life requirements and in the agriculture industry (Hajnalová 1999).

The Ancient terminology gives evidence about historical and cultural value of flax. Greek *linon*, Latin *linum*, and Celtic *lin* have a common origin, but Indo-European languages – *ooma, utasi*, Hebrew *pischta* are completely different (Hyams 1976).

Flax was known as a strategic textile crop in the past. In nowadays, the importance of flax, as an environmentally friendly natural product, is oriented to multilateral use also in non-textile industries. The crop is used in building, paper, and furniture industries. The strong, short fiber is used in new fibrous products, such as car-doors panels, plant pots, briquettes, retaining mats, and many other products. Flax oil is a main ingredient in many fine industrial paints, varnishes and stains. Recently gained new knowledge placed this crop also into the medicine, healthy nutrition, and food industry uses. Flax oil has positive effects in prevention and treatment of serious diseases like breast cancer, prostate cancer, colon diseases, and coronary heart disease.

In the world the interest for flax is increasing due to above mentioned possibilities of use. Nevertheless, the successes in breeding of new flax varieties brought decrease of genetic variability and new varieties and breeding lines refer to a restricted number of genes. A limited spectrum of genetic material was used for their improving. For this reason, the improving, maintaining, evaluation and utilization of flax germplasm are in nowadays the most important directions for flax industry (Zhuchenko et al. 1996; Bačelis 2001). In consequence of a genetic erosion of crops, extension and search for new sources of genetic variability, which can be included to improving process, are needed (Lemesh et al. 2001). Therefore, it is very important to focus attention on evaluation and characterization of genetic resources, situated in the existed collections of flax genotypes. Plant germplasm in general, as well as flax germplasm, has only a small practical value, if available genetic resources are not evaluated and characterized according to an acknowledged evaluation system. The basic way of their use lies in economic value, which is the object of purposeful study and evaluation of variability in individual characters. A complete evaluation and characterization of

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genetic resources is required, for the increase of their usability (Brindza et al. 1998; Chapman 1989; Debre 1998).

The aim of this publication was to offer a unified evaluation system for flax genetic resources. The effort for creation of internationally accepted versatile list of descriptors is initiated by this publication. The system of evaluation and characterization, offered by the descriptor 9-points scale, expects a creation of such uniform and versatile tool.

The publication is divided to three main parts – general chapters, list of descriptors and annexes. It was made for a wide spectrum of users – from laic public and students to scientists, breeders and others working with genetic resources and modern biotechnologies. The general chapters contain overview on taxonomy and morphology of the species *Linum usitatissimum* L. Characterization of plant parts and its terminology are helpful for evaluation by descriptors.

The Descriptor list consists of three parts – the manual, passport descriptors and descriptors for characters evaluation and characterization. The manual contains information about the structure and use of descriptors, as well as general rules for evaluation of flax genetic resources. Passport descriptors were adapted from international systems – EURISCO (2003) and International Flax Database (IFDB 2006). The innovative proposals, which were applied in descriptors (evaluation and characterization) creation, are described in the mentioned chapter. The innovated descriptor list has come out of the following sources:

a. UPOV Flax *Linum usitatissimum* L. (1995),

b. Czech National Descriptor List (Pavelek, Faberová 2000),

c. List of Descriptors compiled by Rosenberg et al. (1978),

d. List of Descriptor VIR (Rykova et al. 1989)

e. Descriptors of IFDB – International Flax Database (2006).

These lists were compared and according to obtained practical experience, as well as a specialized cooperation, the systems of evaluation (structure of individual descriptors) were confirmed or innovated versions were proposed. The base of innovation rested on completing the traits on a detailed method of evaluation, which was enriched by pictures and drawings.

The process of innovation was oriented on performance of requirements for unambiguous system and completeness. After that a need for modification and creation of new descriptor states, verbal characterization and intervals of individual traits variability emerged.

The descriptors for evaluation and characterization are divided in three parts according traits and features, as follows:

3 Morphological traits
- 3.1 Stem
- 3.2 Cotyledons
- 3.3 Leaf
- 3.4 Inflorescence
- 3.5 Flower
- 3.6 Flower petals
- 3.7 Sepals
- 3.8 Reproductive organs
- 3.9 Capsule
- 3.10 Seed

4 Biological features
- 4.1 Vegetative period
- 4.2 Resistance to abiotic factors
- 4.3 Resistance to biotic factors

5 Economic traits
- 5.1 Stem
- 5.2 Seed
- 5.3 Fiber
- 5.4 Fatty acids

The last chapter contains Annexes. The first annex – Growing stages – is tightly connected to individual descriptors. The second annex – Reference varieties – contains the list and basic passport characterization of reference varieties, which are included in the descriptors. The list of reference varieties was compared with the varieties used by UPOV (1995).

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ANCESTOR OF *LINUM USITATISSIMUM* L.

The genus *Linum* L. is relatively large, consist of about 200 – 300 species, mainly spread in temperate climate, in the Mediterranean, and on the prairies of north hemisphere.

Cultivated flax (*Linum usitatissimum* L.) is mostly related to *L. bienne* Mill. (syn. *L. angustifolium* Huds.). Both species are self-pollinated, with the same chromosome number 2n = 30 (Gill, Yermanos 1967; Hajnalová 1999; Zohary, Hopf 1994).

A strong stem, blue flowers and dehiscence capsules are typical for *L. bienne*. Wild forms are biennial, perennial or annual. The self-pollination prevails. *L. bienne* grows mostly on wet, grassy swampy locations, and seepage stony slopes. Sometimes it occurs as a weed on fields with cultivated flax. *L. bienne* is spread in the all Western Europe, the Mediterranean, North Africa, Near East, Iran and on South Caucasus (Hajnalová 1999; Zohary, Hopf 1994).

According to 4000 samples of flax from a worldwide seeds collection in St. Petersburg, Vavilov determined, by a systematically-geographic differentiating method, six homelands of flax: 1. Near East and South Caucasus, 2. Ethiopia and Eritrea, 3. The Mediterranean, 4. East India, 5. Asia Minor, 6. Italia and the Iberian Peninsula (Váša et al. 1965).

According to morphological and biological relationship, *L. bienne* is in nowadays considered an ancestor of *L. usitatissimum.* It is more correct if wild flax is named *L. usitatissimum* subsp. *bienne* instead of *L. usitatissimum.* Main changes from wild to cultivated flax, occurred on modification of capsule from dehiscent to indehiscent, by enlarging the seeds, increasing the oil yield and elongation of stem with increasing of long fiber extraction (Hajnalová 1999; Zohary, Hopf 1994).

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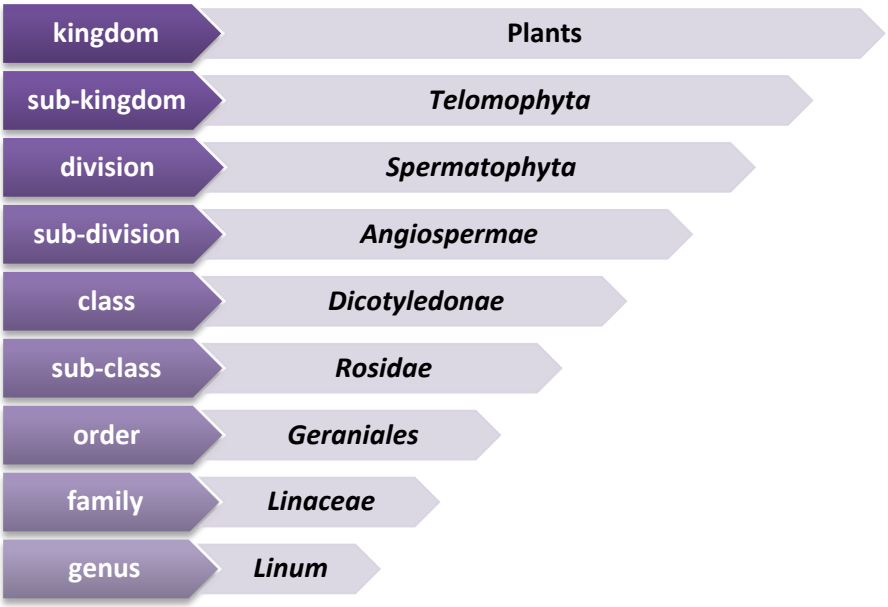
TAXONOMY OF *LINUM USITATISSIMUM* L.

In the genus *Linum* the number of chromosomes varies from 2n = 16 to 2n = 60. Most of the species have either 2n = 18 or 2n = 30 chromosomes (Diederichsen, Richards 2003).

A well known plant species collector and botanist N. I. Vavilov was responsible for a progress in flax taxonomy. The expedition, which Vavilov attended, was realized in about 20 countries of Europe, Asia, Africa and America. About 560 flax unique samples were collected. In nowadays, the collection of flax is stored in The Vavilov Institute in St. Petersburg in Russia, and consists of 5218 accessions from 56 countries. From mentioned collection, 1823 samples represents fiber type, 1781 samples the combined type, 1585 samples the oil type, and 49 samples the wild flax, which covers about 12 species (Kutuzova 1993).

The taxonomical classification of *Linum usitatissimum* L.



The last formal proposal of taxonomical classification was created by Černomorskaja and Stankecič (1987). The species name *usitatissimum* refers to different intraspecific groups of flax. The system that Černomorskaja and Stankecič (1987) proposed is mostly used in Russian literature (Table 1) (Diederichsen, Richards 2003; Kutuzova 1998).

Table 1 Intraspecific groups of *Linum usitatissmum* L. according to Černomorskaja and Stankecič (1987) (Diederichsen, Richards 2003)

Main characteristics	English	Russian	Formal name according to Černomorskaja and Stankecič (1987)	Placement in the system of Kulpa and Danert (1962)
one stem; tall	fiber flax	len-dolgunec	subsp. *usitatissimum*	convar. *elongatum*
one stem; medium height	intermediate flax	len-mežeumok	subsp. *intermedium* Czernom.	convar. *usitatissimum*
several stems; short; late mature	crown flax	len-kudrjaš	subsp. *humile* (Mill.) Czernom.	convar. *mediterraneum* a *usitatissimum*
the weight of 1000 seeds is more than 7g	large-seeded flax	len-krupnosemjannyj	subsp. *latifolium* (L.) Stankev.	convar. *mediterraneum*
prostrate growth habit	semi-winter flax	len-poluzimnyj; len-steljuščyj	subsp. *bienne* (Mill.) Stankev.	convar. *usitatissimum*

Vavilov and Elladi divide the species *Linum usitatissimum* according to dehiscence and size of seeds in two individual species:

1. ***Linum dehiscens* Vav. et Ell. –** involves wild or cultivated types, annual or perennial, with dehiscent capsules. The species consists of the following subspecies:
   a. subsp. *angustifolium* (Huds.) Vav. et Ell. – wild, narrow-leaved flax
   b. subsp. *crepitans* (Boenningh) Vav. et Ell. – dehiscent flax
2. ***Linum indehiscens* Vav. et Ell. –** involves annual, winter types with indehiscent capsules. According to morphology and genetic characters, the following subspecies are included in the species:
   a. subsp. *indoabyssinicum* Vav. et Ell.
   b. subsp. *eurasiaticum* Vav. et Ell.
   c. subsp. *mediterraneum* Vav. et Ell.
   d. subsp. *hindustanicum* Vav. et Ell.
   e. subsp. *transitorium* Vav. et Ell. (Váša et al. 1965).

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Hoffmann (1960) classified individual forms of the species *Linum usitatissimum* L. as follows:

1. ***Linum dehiscens* Vav. et Ell.**
   a. subsp. *angustifolium* (Huds.) Vav. et Ell. – narrow-leaved flax
   b. subsp. *crepitans* (Boenningh) Vav. et Ell. – dehiscent flax

2. ***Linum indehiscens* Vav. et Ell.**
   a. *Linum bienne* Mill. – winter flax
   b. *Linum typicum* – spring flax, according to seed size is divided to:
      - macrospermum – large-seeded – linseed
      - microspermum – small-seeded – fiber flax
      - mesospermum – combined flax (Váša et al. 1965).

Linum typicum has many forms, which Elladi divided to four subspecies:

a. subsp. *indoabyssinicum* Vav. et Ell. – spread in Ethiopia, India and the Himalayas
b. subsp. *aurasiaticum* Vav. et Ell. – cultivated in the Western and Northern Europe, and Asia. Elladi divided this subspecie to 4 varieties:
   - *elongata* – fiber flax
   - *brevimulticaules* – oil flax
   - *intermedia* – combined type cultivated mostly for oil
   - *prostrata* – prostrate flax
c. subsp. *mediterraneum* Vav. et Ell. – spread in the Mediterranean. It belongs to oil types of flax.
d. subsp. *transitorium* Vav. et Ell. - spread in the Mediterranean, an oil type, cultivated in South America (Špaldoň et al. 1982).

MORPHOLOGICAL CHARACTERIZATION OF *LINUM USITATISSIMUM* L.

From the economic point of view, flax can be divided into two types, namely fiber type and oil type, and to one intermediate type - combined fiber and oil types.

ROOT

Shallow root system of flax consists of a main root (Fig. 1) and many of lateral roots. The taproot is short, thin, with fibrous branches, which may in light soil extend to 0.9 – 1.2 m. The main root is straight. Lateral roots are mostly in upper part of root system, where secondary and further branching occurs. The primary lateral roots grow horizontally, approximately 150 mm at oil type (Gill 1987) and 30 mm at fiber type (Mojžíš et al. 1988), and then they sharply turn down and finally grow parallely with the main root. The spatial development of the root system is weak, despite the high portion of fine lateral roots. Lateral branching is suppressed by high density of planting, practiced in fiber flax cultivation. Robustness of root system of fiber type is smaller when compared with oil and combined types. The length of root system depends on soil conditions. The roots are longest during the flowering stage (Gill 1987; Mojžíš et al. 1988; Diederichsen, Richards 2003).

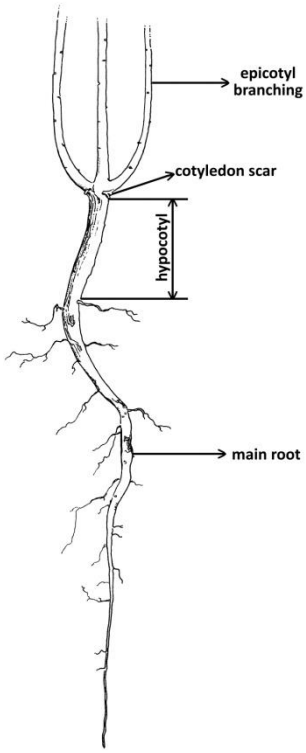

Figure 1 Root and stem branching

The fiber is not present in the root, only hypocotyl contains small amount of less valuable fiber. The length of fiber type hypocotyl is around 25 mm. The oil and combined types have hypocotyl more robust. The cross-section is partially oval (Váša et al. 1965; Rubeš 1957; Krausko 1995).

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STEM

The cross-section of flax stem is usually round to oval (Váša et al. 1965; Rubeš 1957; Krausko 1995). The width of stem is approximately the same along the entire technical length, with small increase in the upper third part of stem (Sizov 1955). The stem width ranges from less than 1.2 mm to more than 2.0 mm (Pavelek, Faberová 2000; Rykova et al. 1989). The method how to characterize stem width is described in the Descriptor 8.

The number of stem shoots, growing out of the plant base part, depends on flax type (fiber, oil, combined). The fiber type has usually only one stem, and is called **one-stem flax** (Descriptor 5). The development of **multi-stem** plants is caused by **basal** and **epicotyl branching** (Fig. 1). If a leading shoot is injured above cotyledons, the plant will develop secondary basal prostrate-ascending shoots. The epicotyl branching is generally typical for oil type. The plant develops lateral branches on the lowest part of the stem above the ground. Their development is influenced by density of planting and soil fertility (Diederichsen, Richards 2003; Váša et al. 1965; Mojžíš et al. 1988).

The stem is the main product of fiber type. Its value is determined by characters presented in the figure 2.

Flax forms panicle-like inflorescence (Diederichsen, Richards 2003). The branching in the upper part of stem is determined by the genotype, but it is also influenced by the environment and the density of planting. The variability of inflorescence shape and size is described in the Descriptors 3, 4 and 17. The fiber type branches only in the upper quarter of the stem; and the oil type can branch from middle part of stem.

The length of flax plant has large range of variation. It ranges approximately from 200 mm to 1500 mm (Descriptor 1).

The character of particular parts of stem varies in dependence on the use type. The stem of oil type should be thicker, shorter, with more robust top branching. The fiber type stem should be long, straight, thin and slender, and with short top branching (Štaud, Vašák et al. 1997).

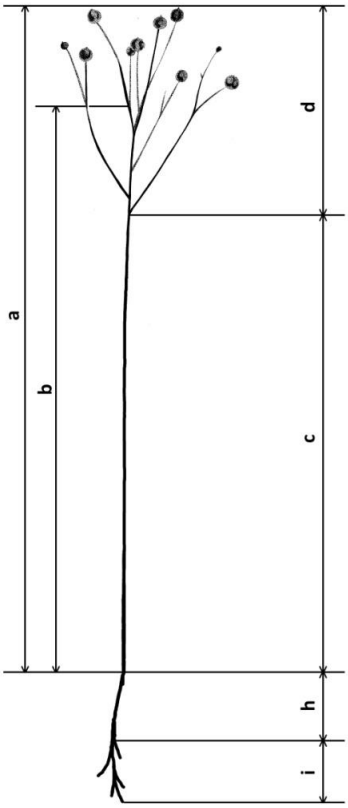

Figure 2 Characterization of flax plant

a. Total length - the length from a cotyledon trace to the highest point of plant;

b. Botanical length - the length from a cotyledon trace to the middle part of inflorescence branching;

c. Technical length - the length from a cotyledon trace to the lowest branch of inflorescence;

d. Inflorescence length – the length from the lowest branch of inflorescence to the highest point of plant;

e. Thickness of stem – is measured in the middle part of technical length of stem;

f. Stem slenderness – the ratio of technical length and stem thickness;

g. Stem convergence – the difference between the diameter of stem near the cotyledons and the diameter of stem at the upper part of technical length;

h. Length of hypocotyl – the distance from cotyledons to the first lateral root;

i. Length of remained part of root – the distance from the first lateral root to the most distal part of the main root (Štaud, Vašák et al. 1997).

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LEAF

Stem of the flax bears leaves. The leaves are alternate, smooth, have three veins, and their size range from 10 to 30 mm (Fir. 3).

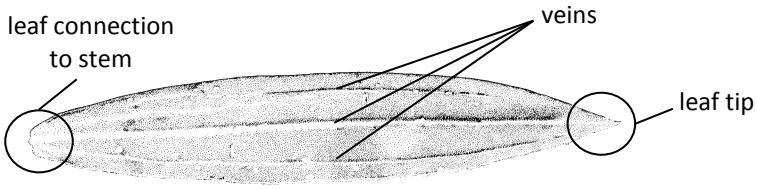

Figure 3 Flax leave with venation

The shape of leaves varies – linear, lanceolate, oval or lanceolate-egg shape (Descriptor 14). In initial growing stages they are covered by a thick wax coat that makes them more resistant to herbicides. The leaf density depends on the use type. The fiber type has less (80 – 100) and thinner leaves than the oil type, that has more leaves (more than 120) and they are large (Diederichsen, Richards 2003; Turayová, Vaňko 1995; Rubeš 1957; Krausko 1995; Váša et al. 1965; Sizov 1955).

FLOWER

The corolla forms a tube, a funnel or a bowl in horizontal view (Descriptor 19). The corolla is of different shape from round to star-shape, in vertical view (Descriptor 20). Its diameter is from 8 to 30 mm (Descriptor 18). Flower of flax has five **sepals**, but sometimes there can occur 4, 6 or 7. The sepals are smooth-edged, membranous at the edge, and usually do not drop (Sizov 1955). The surface is without or with dotting, with smaller or larger intensity of dots (Descriptor 36). This character is important for varieties distinguishing.

The number of **petals** is five, but sparsely can occur 4, 6 or 7. The petals are inversely wedge-shaped. The top part of petals is round and some genotypes have petals with a longitudinal fold (Descriptor 29) or the edges can be folded out or inward (Descriptor 28). They are free, and by noon they drop in a few hours after flower opens (Sizov 1955). The flowers open early in the day. The color of petals varies from white, light blue, blue, dark blue, pink, violet, to red-violet (Diederichsen, Richards 2003). The blue color can have one of the several hues of

different intensity. The veins are colorless or colorful (pink, blue or violet). The petals of fiber type are generally smaller than the petals of oil type.

REPRODUCTIVE ORGANS

The flax flower is hermaphroditical, with five **stamens** and **anthers,** and five **styles** with **stigmas**. Styles are free and slightly connate at the base (Descriptor 37). The styles are surrounded by the stamens (Sizov 1955). There is a large variability in anthers and stigmas color. The anthers vary from white, yellow, through grey and blue to orange (Descriptor 41). The color of stigmas is even more variable (Descriptor 40). The style is characterized with the color, and with the intensity of coloration (Descriptors 38 and 39). Colors of different sterile parts and reproduction organs of flax flower are more or less inherited (Diederichsen, Richards 2003) and could be influenced by environment (Brutch, Porokhovinova 1999). Brutch and Porokhovinova (1999) investigated the genes, involved in the manifestation of selected petals, anthers and seed colors, and found out that some of the genes are expressed only in specific environment. The particular flower parts colors correlate with the colors of particular plant parts (Porokhovinova 1999).

Flax is self-pollinated. Some authors indicate that flax is up to 15% cross-pollinated (Váša et al. 1965; Špaldoň et al. 1982; Krausko 1995). The **pollen grains** can be from pale yellow to orange or even dark blue. The methodology of pollen gathering and characterization is described in the Descriptor 45.

FRUIT

The flax fruit is a capsule. The fruit varies in shape from oblate to globular and cylindrical or conical (Descriptor 46). The capsule has five carpels. Each carpel has two septa separated by incomplete septum (Fig. 4). The septum inside of capsule can be hairy or smooth.

The maximum number of seeds per capsule is 10. A capsule with 6 or 7 carpels occurs sometimes (Sizov 1955). Commonly, the fiber flax produces 7 to 8 seeds per capsule, but large-seeded can form up to 10 seeds (Diederichsen, Richards 2003). The number of seeds per capsule is influenced by many factors, e.g. environment, genotype, density of planting, stem branching (Váša 1965). The ripe capsules can completely open along the septa (dehiscence form), can stay closed (indehiscence form) or can partly open along the septa (Descriptor 51). This character depends on genotype (Diederichsen, Richards 2003).

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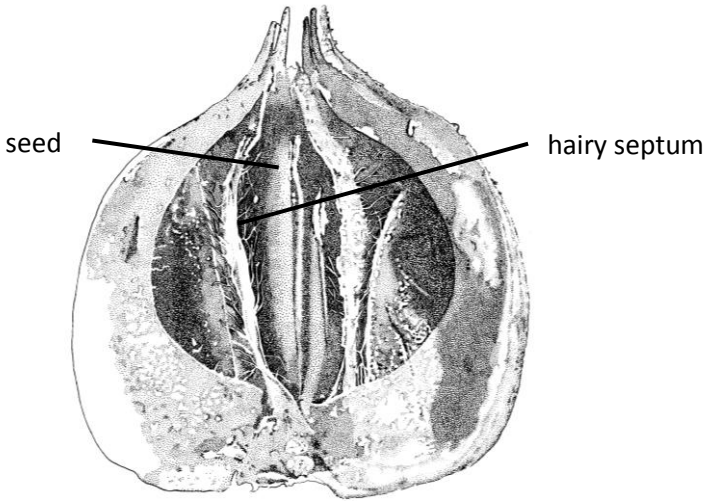

Figure 4 Capsule section

SEED

Flax seeds are usually flattened, slightly convex in the middle, ovoid or oblong elliptic, rounded at the base, and acute at the apex (Sizov 1955; Diederichsen, Richards 2003). Flax seed shape depends on seed width; it can be round or elongated (Descriptor 58). The surface of ripe seed is smooth and glossy. Epidermis in wet environment easily gets mucilaginous and the seed becomes easier contaminated. Because of high amount of mucilaginous substances, flax seeds are often used in pharmaceutical industry (Váša et al. 1965; Krausko 1995). The size of the seeds varies among genotypes. The seed length varies from less than 4.0 to more than 5.25 mm (Descriptor 57). The ripe seed is fully colored. The color of seeds varies from yellow, different hues of brown, to black, can be olive, and even multi-colored seeds can be found (Descriptor 55).

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DEFINITIONS AND USE OF THE DESCRIPTORS

General terms

Accession: An entry in a genebank. A sample, cultivated variety, strain, or bulk population maintained for conservation or use. It is a sample of seeds representing a cultivar, breeding line, or a collected field sample, which is held in storage (IBPGR 1991).

Passport descriptors: Provide general information about an accession (entry of collection), and management (describes way and place of collecting, storage managing), and describe parameters, which are mandatory for identification of accession originality.

Characterization and evaluation descriptors: Describe morphological, biological and economic characters and features of an accession; provide clear information on methodology, schemes, drawings, pictures and evaluation systems for easy discrimination between phenotypes.

Descriptor list: A set of individual characters, used for a description of germplasm of a particular crop or species (Bioversity International 2007).

Descriptor: A basic unit of Descriptor List. It is the evaluation system for genotype classification according to individual trait.

Classification (ranking): The principle of classification is to rank a genotype, according to determined values (verbal or numerical), to specify ranges of a descriptor. There are available at least two states (1 and 9) and maximally nine states for a classification.

Quantitative characters: They are defined by continuous or discrete variation. A continuous variable can take on any value in given range. A discrete value can take on only particular values. The variability of quantitative characters is influenced by environment and has polygenic character.

Qualitative characters: They are defined by nominal or ordinal variables. A nominal variable can be described only verbally, and we cannot quantify it. Typical example of a nominal variable is colour. An ordinal variable allows us to rank order by terms, but still it does not allow quantify the distinctness. The variability of qualitative characters is not influenced by environment as much as the variability of quantitative characters. The qualitative characters are defined by alternative variability.

General format rules for Passport descriptors

Following format rules, as copied from the Multi-Crop Passport Descriptors (FAO/IPGRI 2001), apply to all fields in passport descriptors part:

a. If a field allows multiple values, these values should be separated by a semicolon (;) without space(s). (i.e. Accession name: "Rheinische Vorgebirgstrauben;Emma;Avlon").

b. A field for which no value is available should be left empty (i.e. Elevation). If data are exchanged in ASCII format for a field with a missing numeric value, it should be left empty. If data are exchanged in a database format, missing numeric values should be represented by generic NULL values.

c. Dates are recorded as YYYYMMDD. If the month and/or day are missing this should be indicated with hyphens. Leading zeros are required (i.e. 197506--, or 1975----).

d. Latitude and longitude are recorded in an alphanumeric format. If the minutes or seconds are missing, this should be indicated with hyphens. Leading zeros are required.

e. For coding countries three-letter ISO 3166-1 codes are used (including the codes that are no longer in use in the ISO 3166-1, such as DDR).[1]

f. For coding institutes the FAO Institute Codes should be used as maintained by the FAO. The codes consist of the 3-letter ISO 3166 country code of the country where the institute is located plus a threedigit number.[2]

g. The preferred language for free text fields is English (i.e. Location of collecting site and Remarks).

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[1] The ISO 3166-1 Code List can be found at: http://unstats.un.org/unsd/methods/m49/m49alpha.htm. Country or area numerical codes added or changed are available on-line at: http://unstats.un.org/unsd/methods/m49/m49chang.htm.

[2] These codes are available from: http://apps3.fao.org/wiews/wiews.jsp for registered WIEWS users. From the Main Menu select: 'PGR' and 'Download'. If new Institute Codes are required, they can be generated online by national WIEWS correspondents, or by the FAO WIEWS administrator [Stefano.Diulgheroff@fao.org].

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Structure of Passport descriptors

The 28 descriptors (1 to 28) at the beginning are numbered according to the FAO/IPGRI multi-crop passport descriptors (MCPD) (2001); the first descriptor (numbered 0) and the last five (numbered 29-33) are additional, and specific to this EURISCO Descriptor List (2003). The following descriptors (numbered 34-39) are descriptors adopted from International Flax Database (IFDB 2006) which are missing in the EURISCO Descriptor List. These descriptors allow information specific to genotypes of species *Linum usitatissimum* L.

According to recommendation of EURISCO Descriptors List (2003), only four fields identifying the accession are mandatory, all other fields are highly recommended. The mandatory fields are NICODE (0), INSTCODE (1), ACCENUMB (2) and GENUS (5). The combination of these fields has to be unique.

General format rules for characterization and evaluation descriptors

The following part provides examples and recommendations for objective and proper use of the Descriptor List. There are several principles which have to be recognized and kept when using the descriptors.

The following internationally accepted norms for the scoring, coding and recording of descriptor states should be followed (Bioversity International, IRRI and WARDA 2007):

a. the Système International d'Unités (SI) is used – in the case of measurable traits, and the units are mentioned in brackets following the descriptor name;
b. standard colour chart, e.g. Royal Horticultural Society Colour Chart (RHS), is recommended for all colour characters; but there are also proposed descriptor states for colour variability of different plant parts, and it allows to a user choose the way of characterization;
c. the three-letter abbreviations from the International Standard (ISO) Codes for the representation of names of countries are used (http://unstats.un.org/unsd/methods/m49/m49alpha.htm);

d. alternative characters (absent or present) are scored as in the following Example 1;

Example 1 Structure of alternative character in descriptor STEM – anthocyanin colour of hypocotyl

STEM – anthocyanin color of hypocotyl	
1	absent
9	present

Some Descriptors Lists use “0” for absent and “9” for present in character description. In these descriptors “0” was avoided because in the case of data computerization to electronic catalogue or information system, where a descriptor state “0” would not be accepted.

In this case of alternative characters “1” always formulates absent and “9” present of character description.

e. received numerical data are rounded to number of decimal places displayed in specific descriptor.

There are also the principles, which are specialized to genotypes of species *Linum usitatissimum* L. They should be followed:

a. the accessions, selected for characterization and evaluation, are sown during the spring time;

b. it is strongly recommended to evaluate and characterize accessions in a relevant growing stage, which is mentioned in each descriptor. The list of all growing stages can be found in Annex II.;

c. if it is not written, the evaluation and characterization is realized on plants from the middle part of a field, which are not influenced by a side effect;

d. the habitus of chosen plants should be typical for the genotype, the plants should be healthy, and not damaged.

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Developing and formatting guidelines for the characterization and evaluation descriptors

The Descriptor List for *Linum usitatissimum* L. consists of 94 descriptors for characterization and evaluation. Not all descriptors are mandatory. The descriptors are chosen according to user´s purposes (breeding, testing of new variety – DUS tests, or characterization of variability).

This list was created from 5 internationally known and used Descriptor Lists - UPOV (1995), national list of descriptors of the Czech Republic (Pavelek, Faberová 2000), list of descriptors created by Rosenberg and co-authors (Rosenberg et al. 1978), VIR list of descriptors (Rykova et al. 1989), and IFDB list of descriptors named International Flax Data Base (2006).

The mentioned lists were compared. Some of the descriptors were adopted, some were innovated, and some descriptors are new. Descriptor innovation followed principles and knowledge mentioned below.

The descriptors included in the List cover presently known variability of morphological, biological and economical traits and characters. If a new feature, allowing better distinguishing of flax genotypes appears in the future, there are described methods and techniques (mentioned below) for preparing a new descriptor (system of new feature evaluation and characterization).

Completeness

The descriptor´s states should allow classifying of each measured or characterized sample (Example 2). This principle is related to quantitative and qualitative characters.

Example 2 Descriptor for quantitative character – principle of completeness

FLOWER – diameter of open corolla [mm]		
1	very small	< 10.0
3	small	10.0 – **15.9**
5	medium	**16.0** – 21.9
7	large	22.0 – 27.9
9	very large	>27.9

The completeness in descriptors for quantitative traits is kept also by structure of ranges (open or closed interval) – Example 3.

Example 3 Structure of open and closed intervals in descriptor states

FLOWER – diameter of open corolla [mm]			
1	very small	< 10.0	**(0;10.0)**
3	small	10.0 – 15.9	**[10.0;15.9]**
5	medium	16.0 – 21.9	**[16.0;21.9]**
7	large	22.0 – 27.9	**[22.0;27.9]**
9	very large	>27.9	**(27.9;∞)**

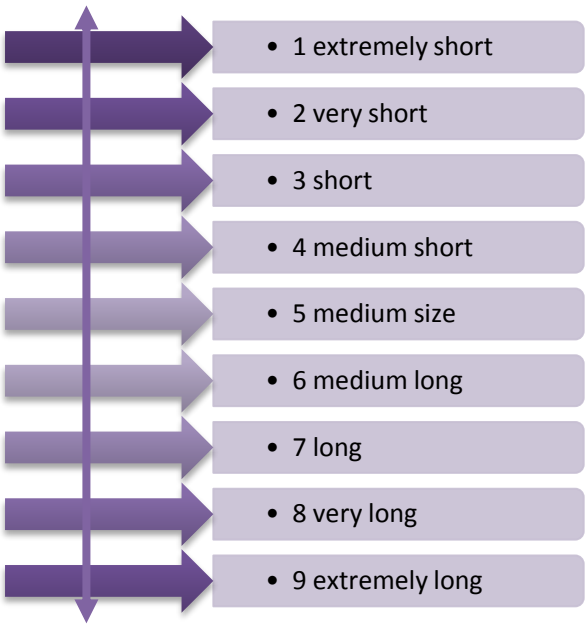
Uniform and unambiguous system

A descriptor should be a system, providing to any user a clear way of an accession characterization, by the methodology, drawings, pictures, and descriptor states. It should provide a uniform system for accession characterization in different regions of the world.

Polarity of descriptor states

In the descriptors for quantitative traits, a principle of polarity in verbal definitions of descriptor states should be kept (Example 4).

Example 4 Descriptor for STEM - total length (mm) – polarity in verbal definition



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Measurement ranges

It is strongly recommended to use the actual measurements (i.e. g, mm) for making good use of quantitative data (i.e. continuous variation) for genetic diversity variation (Bioversity International 2007). To avoid misinterpretation by different users, it is important to specify relevant ranges of measurements.

In this Descriptor List a mathematical method – principle of membership function of fuzzy set for specifying ranges (Stehlíková 2004) was used. The first step was a specification of border values for each trait; it means total minimal and maximal values, which can plant reach in tested trait, independently of agro-environmental conditions. Through this two points (border values) a line

$$y = y_1 + \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$$

is unambiguously determined. In our case, x1 = min and x2 = max, y1 = 0 and y2 = 1.

Then the equation of the line is

$$y = \frac{1}{\max - \min}(x - \min)$$

From the equation,

$$x = min + (max - min)y$$

the variable “x” was defined, which is needed for a calculation of border points for individual intervals of trait. The following values - 0.2; 0.4; 0.5; 0.6; 0.8 were bounded to variable “y”.

Descriptors for qualitative characters

The classification numbers of descriptor states are in succession (i.e. 1, 2, 3 …). In dependence on variability in particular character (shape, colour etc.), there is an agreed number of states.

The descriptor state “9 = other” (Example 5) is open for new possibilities of variability, which are not classified yet. In the case of ordinal scales the descriptor states are not in succession.

Example 5 Descriptor for a qualitative character – structure of states

COTYLEDONS – shape	
1	egg-shaped
2	rounded
3	oval
9	other

Descriptor name

It should be descriptive, unambiguous and as compact as possible (Bioversity International 2007). The structure of descriptor name should be unified and with correct technical terms, understandable by any users.

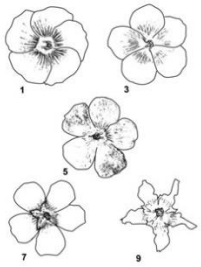
Descriptor method

It is a method, describing the main details about the measurement and classification (Example 6). Details, such as which part of a plant should be measured, what amount of the material is recommended for the measurement, a recommended growing stage, and other information specifying a characterized trait are included there.

Example 6 Descriptor for FLOWER – shape of corolla

20. FLOWER – corolla shape
Rosenberg et al. 1978; Diederichsen 2001

1	circled (the petals overlap more than 75 %)
3	slightly sinuate (the petals overlap more than 50 % to 75 %)
5	medium sinuate (the petals overlap more than 25 % to 50 %)
7	deeply sinuate (the petals overlap up to 25 %)
9	star shaped (the petals ordinarily not overlapped)



Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;
Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, color; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen.

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Drawings

Drawings and pictures help users to select proper states of descriptor and avoid confusion caused by environmental effects (Bioversity International 2007). They also provide a clear way of characterization for any user.

Reference varieties (standard varieties)

They are mostly included in UPOV (1995) descriptors. They are usually used for testing distinctness, uniformity and stability of new varieties in well known DUS tests (Kiewiet 2005). A new variety is compared with a list of reference varieties in particular traits (UPOV 2004). It is recommended to keep the whole collection of reference varieties. Selected reference varieties have to be uniform, stable and distinct in particular character in different environmental conditions.

In this Descriptor List, the reference varieties are used for traits where the interpretation would be misleading (mostly for qualitative traits). The standards are also used in selected descriptors for evaluation of resistance to diseases.

PASSPORT DESCRIPTORS

1. General passport descriptors adopted by EURISCO (2003)

0.	**National Inventory code**	**NICODE**
Code identifying the National Inventory; the code of the country preparing the National Inventory. Exceptions are possible, if agreed with EURISCO such as NGB. Example: NLD		
1.	**Institute code**	**INSTCODE**
FAO Institute Code of the institute where the accession is maintained. Example: NLD037		
2.	**Accession number**	**ACCENUMB**
This number serves as a unique identifier for accessions within a genebank collection, and is assigned when a sample is entered into the genebank collection. Example: CGN00254		
3.	**Collecting number**	**COLLNUMB**
Original number assigned by the collector(s) of the sample, normally composed of the name or initials of the collector(s) followed by a number. This number is essential for identifying duplicates held in different collections. Example: FA90-110		
4.	**Collecting institute code**	**COLLCODE**
Code of the Institute collecting the sample. If the holding institute has collected the material, the collecting institute code (COLLCODE) should be the same as the holding institute code (INSTCODE). Example: NLD037		
5.	**Genus**	**GENUS**
Genus name for taxon, in latin. Initial uppercase letter required. Example: Allium		
6.	**Species**	**SPECIES**
Specific epithet portion of the scientific name, in latin, in lowercase letters. Following abbreviation is allowed: ‘sp.’ Example: paniculatum		

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7.	Species authority	SPAUTHOR
The authority for the species name. Example: L.		
8.	**Subtaxa**	**SUBTAXA**
Subtaxa can be used to store any additional taxonomic identifier, in latin. Following abbreviations are allowed: 'subsp.' (for subspecies); 'convar.' (for convariety); 'var.' (for variety); 'f.' (for form). Example: subsp. fuscum		
9.	**Subtaxa authority**	**SUBTAUTHOR**
The subtaxa authority at the most detailed taxonomic level. Example: (Waldst. et Kit.) Arc.		
10.	**Common crop name**	**CROPNAME**
Name of the crop in colloquial language, preferably English. Example: malting barley Example: cauliflower		
11.	**Accession name**	**ACCENAME**
Either a registered or other formal designation given to the accession. First letter uppercase. Multiple names separated with semicolon without space. Example: Rheinische Vorgebirgstrauben;Emma;Avlon		
12.	**Acquisition date**	**ACQDATE**
Date on which the accession entered the collection as YYYYMMDD. Missing data (MM or DD) should be indicated with hyphens. Leading zeros are required. Example: 1968---- Example: 20020620		
13.	**Country of origin**	**ORIGCTY**
Code of the country in which the sample was originally collected. Example: NLD		
14.	**Location of collecting site**	**COLLSITE**
Location information below the country level that describes where the accession was collected. This might include the distance in kilometres and direction from the nearest town, village or map grid reference point Example: 7 km south of Curitiba in the state of Parana		

15. Latitude of collecting site	**LATITUDE**
Degree (2 digits) minutes (2 digits), and seconds (2 digits) followed by N (North) or S (South). Every missing digit (minutes or seconds) should be indicated with a hyphen. Leading zeros are required Example: 10----S Example: 011530N Example: 4531--S	
16. Longitude of collecting site	**LONGITUDE**
Degree (3 digits), minutes (2 digits), and seconds (2 digits) followed by E (East) or W (West). Every missing digit (minutes or seconds) should be indicated with a hyphen. Leading zeros are required. Example: 0762510W Example: 076----W	
17. Elevation of collecting site	**ELEVATION**
Elevation of collecting site expressed in meters above sea level. Negative values are allowed. Example: 763	
18. Collecting date of sample	**COLLDATE**
Collecting date of the sample as YYYYMMDD. Missing data (MM or DD) should be indicated with hyphens. Leading zeros are required. Example: 1968---- Example: 20020620	
19. Breeding institute code	**BREDCODE**
FAO Institute Code of the institute that has bred the material.	
20. Biological status of accession	**SAMPSTAT**
The coding scheme proposed can be used at 3 different levels of detail: either by using the general codes (in boldface) such as 100, 200, 300, 400 or by using the more specific codes such as 110, 120 etc. 100) Wild 110) Natural 120) Semi-natural/wild 200) Weedy 300) Traditional cultivar/landrace	

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400) Breeding/research material
- 410) Breeder's line
  - 411) Synthetic population
  - 412) Hybrid
  - 413) Founder stock/base population
  - 414) Inbred line (parent of hybrid cultivar)
  - 415) Segregating population
- 420) Mutant/genetic stock

500) Advanced/improved cultivar
999) Other (Elaborate in REMARKS field)

21. Ancestral data **ANCEST**

Information about either pedigree or other description of ancestral information (i.e. parent variety in case of mutant or selection).

Example: Hanna/7*Atlas//Turk/8*Atlas
Example: mutation found in Hanna
Example: selection from Irene
Example: cross involving amongst others Hanna and Irene

22. Collecting/acquisition source **COLLSRC**

The coding scheme proposed can be used at 2 different levels of detail: either by using the general codes (in boldface) such as 10, 20, 30, 40 or by using the more specific codes such as 11, 12 etc.

10) Wild habitat
- 11) Forest/woodland
- 12) Shrubland
- 13) Grassland
- 14) Desert/tundra
- 15) Aquatic habitat

20) Farm or cultivated habitat
- 21) Field
- 22) Orchard
- 23) Backyard, kitchen or home garden (urban, peri-urban or rural)
- 24) Fallow land
- 25) Pasture
- 26) Farm store
- 27) Threshing floor
- 28) Park

30) Market or shop
40) Institute, Experimental station, Research organization, Genebank
50) Seed company
60) Weedy, disturbed or ruderal habitat
61) Roadside
62) Field margin
99) Other (Elaborate in REMARKS field)

23.	**Donor institute code**	**DONORCODE**

FAO Institute Code for the donor institute.

24.	**Donor accession number**	**DONORNUMB**

Number assigned to an accession by the donor.

Example: NGB1912

25.	**Other identification (numbers) associated with the accession**	**OTHERNUMB**

Any other identification (numbers) known to exist in other collections for this accession. Use the following system:
INSTCODE:ACCENUMB;INSTCODE:ACCENUMB;… INSTCODE and ACCENUMB follow the standard described above and are separated by a colon. Pairs of INSTCODE and ACCENUMB are separated by a semicolon without space. When the institute is not known, the number should be preceded by a colon.

Example: NLD037:CGN00254
Example: SWE002:NGB1912;:Bra2343

26.	**Location of safety duplicates**	**DUPLSITE**

FAO Institute Code of the institute where a safety duplicate of the accession is maintained. The codes consist of the 3- letter ISO 3166 country code of the country where the institute is located plus a number.

27.	**Type of germplasm storage**	**STORAGE**

If germplasm is maintained under different types of storage, multiple choices are allowed (separated by a semicolon). (Refer to FAO/IPGRI Genebank Standards 1994 for details on storage type.)

10) Seed collection
11) Short term
12) Medium term
13) Long term
20) Field collection
30) In vitro collection (Slow growth)

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40) Cryopreserved collection
99) Other (elaborate in REMARKS field)

28.	Remarks	REMARKS

The remarks field is used to add notes or to elaborate on descriptors with value 99 or 999 (=Other). Prefix remarks with the field name they refer to and a colon. Separate remarks referring to different fields are separated by semicolons without space.

Example: COLLSRC:roadside

29.	Decoded collecting institute	COLLDESCR

Brief name and location of the collecting institute. Only to be used if COLLCODE can not be used since the FAO Institution Code for this institute is not (yet) available.

Example: Tuinartikelen Jan van Zomeren, Arnhem, The Netherlands

30.	Decoded breeding institute	BREDDESCR

Brief name and location of the breeding institute. Only to be used if BREDCODE can not be used since the FAO Institution Code for this institute is not (yet) available.

Example: CFFR from Chile

31.	Decoded donor institute	DONORDESCR

Brief name and location of the donor institute. Only to be used if DONORCODE cannot be used since the FAO Institution Code for this institute is not (yet) available.

Example: Nelly Goudwaard, Groningen, The Netherlands

32.	Decoded safety duplication location	DUPLDESCR

Brief name and location of the institute maintaining the safety duplicate. Only to be used if DUPLSITE can not be used since the FAO Institution Code for this institute is not (yet) available.

Example: Pakhoed Freezers inc., Paramaribo, Surinam

33.	Accession URL	ACCEURL

URL linking to additional data about the accession either in the holding genebank or from another source.

Example:
www.cgn.wageningen-ur.nl/pgr/collections/passdeta.asp?accenumb=CGN04848

2. Non-standard passport descriptors for flax genotypes (*Linum usitatissimum* L.)

The following passport descriptors are adopted by International Flax Database Descriptor List (IFDB 2006).

34.	**Type of use**	**USETYPE**
Characterization of plant type 1 flax 2 linseed 3 combined/intermediate		
35.	**Ploidy**	**PLOIDY**
Basic number of chromosomes 1 haploid (n) 2 diploid (2n) 3 triploid (3n) 4 tetraploid (4n) 5 pentaploid (5n) 6 hexaploid (6n) 7 heptaploid (7n) 8 octoploid (8n) 9 polyploid (9n)		
36.	**Character of material**	**CHARMATER**
Characterization of accessions regarding to their originating 1 unselected 2 selected		
37.	**Growth habit**	**GROWTHHAB**
Course of life according the time of sowing 1 spring 2 intermediate 3 winter		

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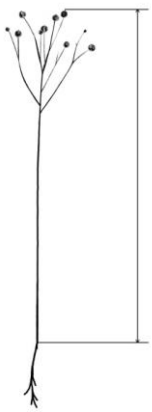
38.	**Type of life**	**LIFETYPE**
Course of living cycle during the year 1 annual 2 bennial 3 perennial		
39.	**Availability of material**	**AVAILAB**
Information whether the seed of the accessions is available Y – yes R – restricted N – no		

DESCRIPTORS FOR CHARACTERIZATION AND EVALUATION

3 Morphological traits

3.1.1 STEM – total plant length [mm]

Descriptor states		Ranges	Reference varieties
1	extremely short	< 310	Amazon (O), Mikael (O)
3	short	310 - 649	Liflora (O)
4	medium short	650 - 769	Amon (O)
5	medium	770 - 879	Jitka (F)
6	medium long	880 - 999	Viking (F)
7	long	1000 - 1339	Ariane (F)
9	extremely long	> 1339	HeiYa (F)



Growing stage: linseed (O) = 97 or 99 (after harvest), fiber flax (F) = 81 (after harvest) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field, minimally 15 plants;
Method: In the case of epicotyl branching (Descriptor 5), the evaluation is realized on the main stem, from the end of hypocotyl to the highest point of a plant.

3.1.2 STEM – technical length [mm]

Descriptor states		Ranges	Reference varieties
1	extremely short	< 250	Amazon (O), Mikael (O)
3	short	250 - 549	Liflora (O)
4	medium short	550 - 649	Amon (O)
5	medium	650 - 749	Jitka (F)
6	medium long	750 - 849	Viking (F)
7	long	850 - 1149	Ariane (F)
9	extremely long	> 1149	HeiYa (F)

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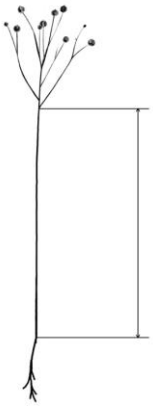
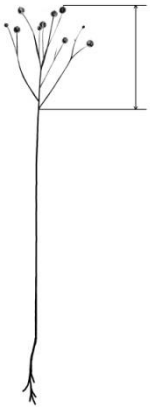


Growing stage: linseed (O) = 97 or 99 (after harvest), fiber flax (F) = 81 (after harvest) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field, minimally 15 plants;
Method: In the case of epicotyl branching (Descriptor 5), the evaluation is realized on the main stem, from the end of hypocotyl to the place, where the top branching starts. In the case of cyclic flowering, the top branching starts with the fully developed branches (Descriptor 4).

3.1.3 STEM – panicle-like size [%]

Descriptor states		Ranges
1	very short	< 7
3	short	7 – 21
5	medium	22 – 34
7	long	35 – 48
9	very long	> 48

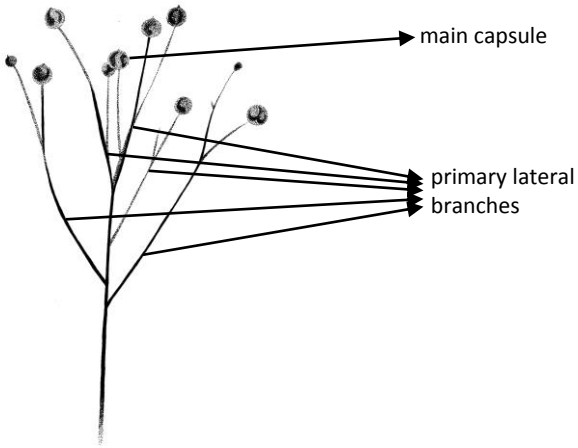


Growing stage: linseed (O) = 97 or 99 (after harvest), fiber flax (F) = 81 (after harvest) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field, minimally 15 plants;
Method: In the case of epicotyl branching (Descriptor 5), the evaluation is realized on the main stem, namely from the place, where the top branching starts to the highest point of plant. In the case of cyclic flowering, the top branching starts with the fully developed branches (Descriptor 4). The percentage of total length of stem is evaluated.

3.1.4 STEM – number of primary lateral branches of inflorescence [no]

Pavelek, Faberová 2000

Descriptor states		Ranges
3	low	< 4
5	medium	4-8
7	high	> 8



Growing stage: linseed (O) = 97 or 99 (after harvest), fiber flax (F) = 81 (after harvest) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field, minimally 15 plants;
Method: In the case of epicotyl branching (Descriptor 5), the evaluation is realized on the main stem. Only primary lateral branches of inflorescence are counted. These branches grow straight from the main stem. The main stem ends with an apical capsule, which is overgrown and surrounded by capsules, growing on secondary and tertiary lateral branches of the inflorescence. The apical capsule is the largest and the first reaches full maturity. In the case of cyclic flowering, the top branching starts with the fully developed branches (Descriptor 4).

3.1.5 STEM – epicotyl branching

Pavelek, Faberová 2000; Rosenberg et al. 1978

Descriptor states	
1	one-stem
2	multi-stem

Growing stage: linseed (O) = 97 or 99 (after harvest), fiber flax (F) = 81 (after harvest) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field;

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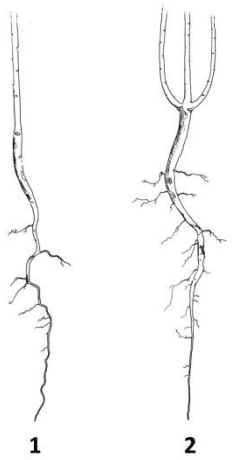

Method: Multi-stem plants develop more than one stem at the density of planting for common cultivation (fiber flax – 2200 plants per m^2; linseed – 900 plants per m^2). The main stem is branching in hypocotyls area, it is the highest stem, the flowers and capsules develop first. If the leading shoot is injured, the plant develops the secondary basal prostrate-ascending sprouts, and this kind of plant in not classifying as multi-stem plant. The genotype is characterized as multi-stem when minimally 50 % of the plants develop more than one stem. One-stem plant develops only one shoot.

3.1.6 STEM – position of plant top

Pavelek, Faberová 2000; Rosenberg et al. 1978

Descriptor states	
3	erect
5	semi erect
7	nodding

Growing stage: (O, F) = 32 - 34 (Annex I);
Material: typical, undamaged plants, selected from the middle part of a field;
Method: The most frequent position of plant top is selected by visual consideration. This trait is important for evaluation of resistance of plants to stem lodging.

3.1.7 STEM – foliation [no]

Rykova et al. 1989

Descriptor states	
3	weak
5	medium
7	strong

Growing stage: linseed (O) = 97 or 99 (after harvest), fiber flax (F) = 81 (after harvest) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field, minimally 15 plants;
Method: In the case of epicotyl branching (Descriptor 5), the evaluation is realized on the main stem (number of leaves on technical length of stem – Descriptor 2). The stem is gradually rolled in fingers and leaf scars are identified by touch. The number of scars determines the number of developed leaves (Brutch 2001).

3.1.8 STEM – thickness [mm]

Pavelek, Faberová 2000; Rykova et al. 1989

Descriptor states		Ranges
3	thin	< 1.2
5	medium	1.2 – 2.0
7	thick	> 2.0

Growing stage: linseed (O) = 97 or 99 (after harvest), fiber flax (F) = 81 (after harvest) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field with common density of planting (F – 2200 plants per m^2, O – 900 plants per m^2), minimally 15 plants;
Method: In the case of epicotyl branching (Descriptor 5), the evaluation is realized on the main stem, namely in the middle part of technical length of stem (Descriptor 2). The stem thickness is measured with accuracy to one decimal place.

3.1.9 STEM – thickness of hypocotyl [mm]

Descriptor states		Ranges
3	thin	< 2.9
5	medium	2.9 – 4.3
7	thick	> 4.3

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Growing stage: linseed (O) = 97 or 99 (after harvest), fiber flax (F) = 81 (after harvest) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field with common density of planting (F – 2200 plants per m^2, O – 900 plants per m^2), minimally 15 plants;
Method: In the case of epicotyl branching (Descriptor 5), the evaluation is realized on the main stem, namely on the place tightly below the cotyledons (remained scars after cotyledons). The hypocotyl thickness is measured with accuracy to one decimal place.

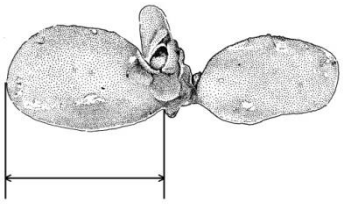
3.1.10 STEM – anthocyanin colour of hypocotyl

Descriptor states	
1	absent
9	present

Growing stage: (O, F) = 11 – 12, during first days (Annex I);
Material: typical, undamaged plants, selected from the middle part of a field;
Method: Anthocyanin colour of hypocotyl is related to genotype but, the weather can cause that this character is not manifested.

3.2.11 COTYLEDONS – length [mm]

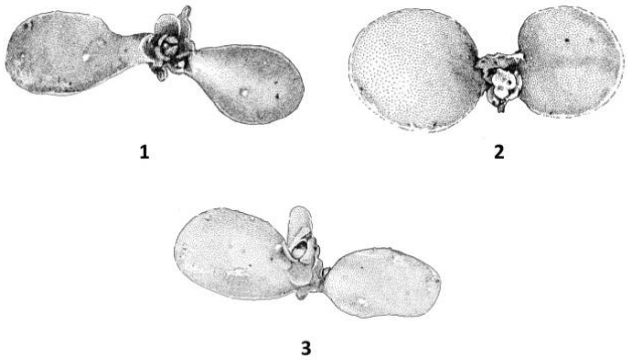
Descriptor states		Ranges
3	short	< 11.2
5	medium	11.2 – 14.8
7	long	> 14.8



Growing stage: (O, F) = 10 – 19 (Annex I);
Material: typical, undamaged leaves, selected from the middle part of a field, minimally 15 leaves from randomly selected plants;
Method: The longest part of the leaf is measured. The size of cotyledons correlates with the size of seeds. If seeds are large and developed, the cotyledons as well.

3.2.12 COTYLEDONS – shape

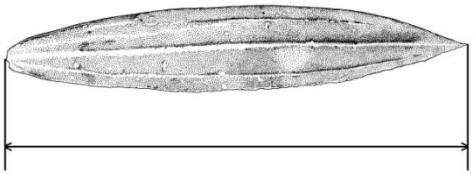
Descriptor states	
1	ovate
2	circled
3	elliptical
9	other



Growing stage: (O, F) = 10 – 16 (Annex I);
Material: typical, undamaged leaves, selected from the middle part of a field, minimally 15 leaves from randomly selected plants;
Method: Evaluation is realized when plants develop to the stage fir like (Annex I). The most frequent shape of cotyledons is selected by visual consideration.

3.3.13 LEAF – length [mm]

Descriptor states		Ranges
3	short	< 17.0
5	medium	17.0 – 23.0
7	long	> 23.0



Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I (Descriptors 63, 64);

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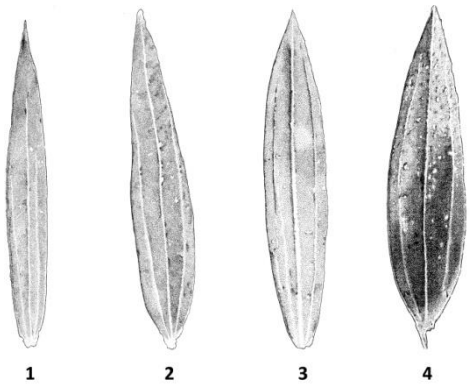
Material: typical, undamaged leaves, selected from the middle part of a field, minimally 15 leaves from randomly selected plants;
Method: The longest part of leaf is measured. The leaf is removed from middle part of the technical length of stem (Descriptor 2) on the main stem (Descriptor 5).

3.3.14 LEAF – shape

Descriptor states	
1	linear
2	lanceolate
3	oval
4	ovate lanceolate
9	other



Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I (Descriptors 63, 64);
Material: typical, undamaged leaves, selected from the middle part of a field;
Method: For evaluation are suitable leaves from the middle part of the technical length of stem (Descriptor 2), on the main stem (Descriptor 5). Evaluation is oriented on the widest leaf part.

3.3.15 LEAF – colour

Pavelek, Faberová 2000; Rykova et al. 1989

Descriptor states		RHS codes
1	light green	144 A
2	green	143 A, B, C
3	dark green	137 A,B,C,D; 138 A
9	other	

Growing stage: (O, F) = 33 – 37 (Annex I);
Material: typical, undamaged leaves, selected from the middle part of a field;
Method: Anthocyanin colour occurs on the leaf point and causes brown colour.

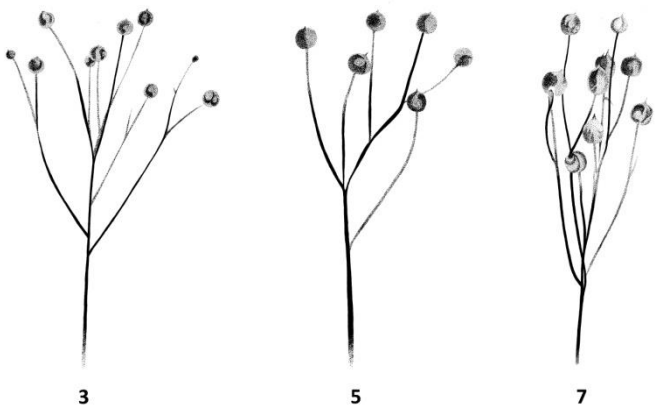
3.3.16 LEAF – anthocyanin colour
Rosenberg et al. 1978

Descriptor states	
1	absent
9	present

Growing stage: (O, F) = 33 – 37 (Annex I);
Material: typical, undamaged leaves, selected from the middle part of a field;
Method: Anthocyanin colour occurs on the leaf point and causes brown colour.

3.4.17 INFLORESCENCE – shape
Rykova et al. 1989

Descriptor states	
3	branchy
5	moderately compact
7	compact

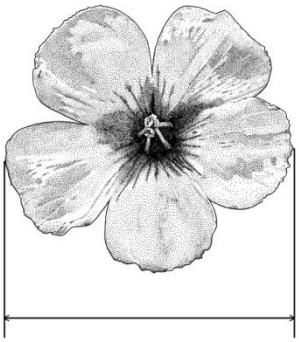


Growing stage: linseed (O) = 97 or 99 (after harvest), fiber flax (F) = 81 (after harvest) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field;
Method: In the case of epicotyl branching (Descriptor 5), the evaluation is realized on the main stem.

http://dx.doi.org/10.15414/2016.9788055214849

3.5.18 FLOWER – diameter of opened flower [mm]

Descriptor states		Ranges
1	very small	< 10.0
3	small	10.0 – 15.9
5	medium	16.0 – 21.9
7	large	22.0 – 27.9
9	very large	> 27.9



Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field, minimally 15 flowers from randomly selected plants;
Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather, when the flowers have typical, not pale, colour. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen.

3.5.19 FLOWER – degree of corolla opening

Rosenberg et al. 1978

Descriptor states	
1	plate like
3	funnel plate like
5	funnel
7	funnel tubular
9	tubular

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;

Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather, when the flowers have typical, not pale, colour. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen.

3.5.20 FLOWER – corolla shape

Rosenberg et al. 1978; Diederichsen 2001

Descriptor states	
1	circled (the petals overlap more than 75 %);
3	slightly sinuate (the petals overlap more than 50 % to 75 %);
5	medium sinuate (the petals overlap more than 25 % to 50 %);
7	deeply sinuate (the petals overlap up to 25 %);
9	star shaped (the petals ordinarily not overlapped)

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;

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Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen.

3.6.21 FLOWER PETALS – colour shortly before flower opens

Descriptor states		Reference varieties
1	white	Regina (F)
2	light blue	
3	blue	
4	violetblue	Viking (F)
5	violet	Liflora (O), Viola (F)
6	redviolet	
7	pink	Hella (O)
9	other	

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;
Method: The colour is evaluated on petals which are visible in buds, shortly before flower opens. The evaluation is realized in the morning before flower opens, during the sunny, not extremely dry weather. The buds suitable for evaluation are the best developed. The apical buds (Descriptor 4) are appropriate and buds grown on primary lateral branches of inflorescence. Besides visual evaluation of colour, it is recommended to use the colour chart - The Royal Horticultural Society's Colour Chart (RHS).

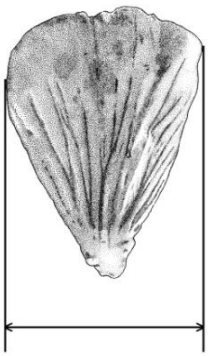
3.6.22 FLOWER PETALS – colour at the stage of fully opened flower

Descriptor states		Reference varieties	RHS codes
1	white	Regina (F)	
2	light blue	Antares (O)	92 C; 97 D
3	blue	Viking (F)	
4	violetblue		91 A, B, C; 92 A, B, C; 93 C, D; 94 B, C, D
5	violet	Liflora (O)	90 D
6	redviolet	Olinette (O)	
7	pink		65 D
9	other		

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;
Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather, when the flowers have typical, not pale, colour. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen. Besides visual evaluation of colour, it is recommended to use the colour chart - The Royal Horticultural Society's Colour Chart (RHS).

3.6.23 FLOWER PETALS – width [mm]

Descriptor states		Ranges
1	very narrow	< 3.5
3	narrow	3.5 – 6.8
5	medium	6.9 – 10.0
7	wide	10.1 – 13.4
9	very wide	> 13.4



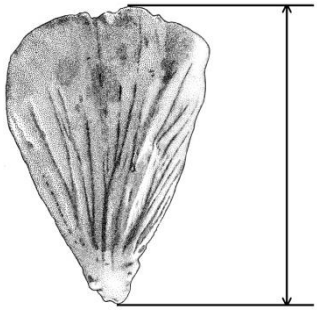
Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field, minimally 15 flowers from randomly selected plants;

http://dx.doi.org/10.15414/2016.9788055214849

Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen.

3.6.24 FLOWER PETALS – length [mm]

Descriptor states		Ranges
1	very short	< 6.3
3	short	6.3 – 10.4
5	medium	10.5 – 13.4
7	long	13.5 – 17.6
9	very long	> 17.6

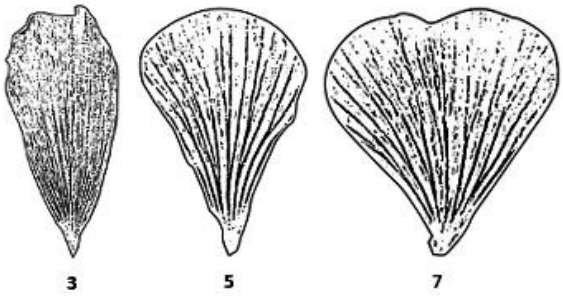


Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field, minimally 15 flowers from randomly selected plants;
Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen.

3.6.25 FLOWER PETALS - shape

Descriptor states		Ranges
3	narrow	(1:3)
5	elliptical	(2:3; 3:2)
7	circular	(1:1)

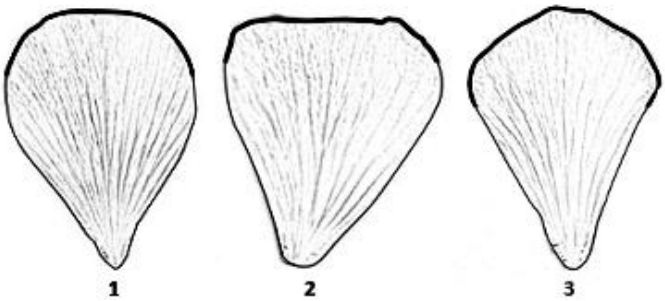
Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;



Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen. From a selected flower all flower petals are evaluated. The petals are removed from open flowers until they drop off. The shape of petal is expressed by the ration of the width to the length.

3.6.26 FLOWER PETALS - margin

Descriptor states	
1	circular
2	straight
3	acute
9	other



Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;
Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not

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pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen. From a selected flower all flower petals are evaluated. The petals are removed from open flowers until they drop off.

3.6.27 FLOWER PETALS – margin shape

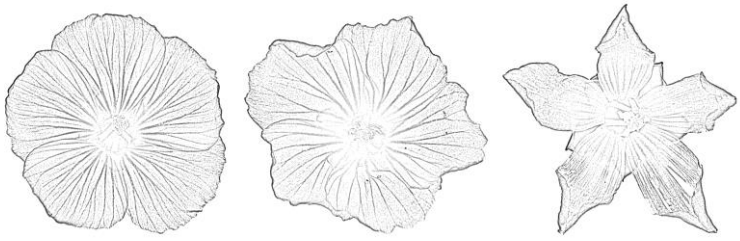
Descriptor states	
1	even
2	crenate
3	coarsely crenate
9	other

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;
Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen. From a selected flower all flower petals are evaluated. The petals are removed from open flowers until they drop off.

3.6.28 FLOWER PETALS – margin folding

Descriptor states	
1	plain
2	folded
3	folded inwards
9	other

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;



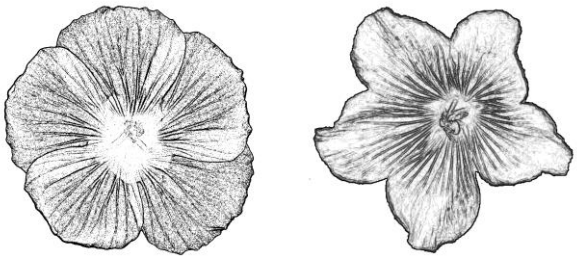
1 2 3

Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen. From a selected flower all flower petals are evaluated. The petals are removed from open flowers until they drop off.

3.6.29 FLOWER PETALS – longitudinal folding

UPOV 1995; IFDB 2006

Descriptor states	
1	absent
9	present



1 9

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;

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Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen. From a selected flower all flower petals are evaluated. The petals are removed from open flowers until they drop off.

3.6.30 FLOWER PETALS – colour of veins if one-coloured

Descriptor states		RHS codes
1	white	95 A, B; 96 A-D; 97 A, B; 98 A-C; 99 A, B, D
2	yellow	
3	pink	
4	violet	
5	blue	
9	other	

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;
Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen. From a selected flower all flower petals are evaluated. The petals are removed from open flowers until they drop off.

3.6.31 FLOWER PETALS – colour of veins if colourful

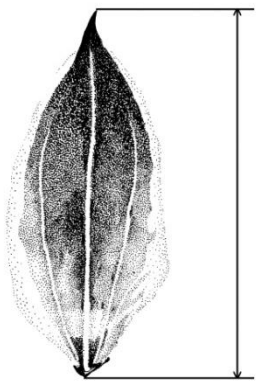
Descriptor states	
1	blue at the base, follow white
2	blue at the base, follow violet
3	blue at the base, follow pink
9	other

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;

Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen. From a selected flower all flower petals are evaluated. The petals are removed from open flowers until they drop off.

3.7.32 SEPALS – length [mm]

Descriptor states		Ranges
3	short	< 6.0
5	medium	6.0 – 9.0
7	long	> 9.0



Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field, minimally 15 flowers from randomly selected plants;
Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen. From a selected flower all flower sepals are evaluated. The longest part of sepal is measured.

3.7.33 SEPALS - termination

Descriptor states	
1	longitudinally acute
2	acute
3	shortly acute

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;

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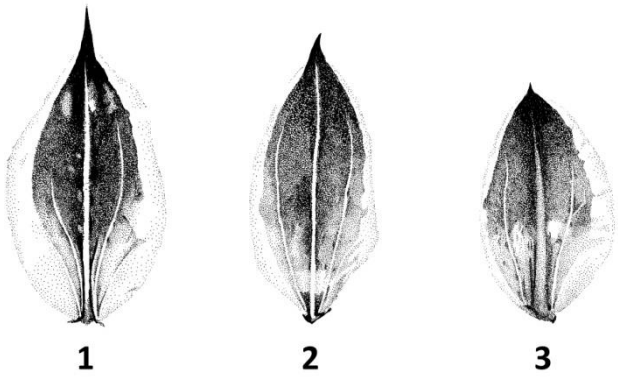


Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen. From a selected flower all flower sepals are evaluated.

3.7.34 SEPALS – vein protrusion above the area of sepal

Descriptor states	
1	absent
9	present

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;
Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen. From a selected flower all flower sepals are evaluated.

3.7.35 SEPALS – anthocyanin colour

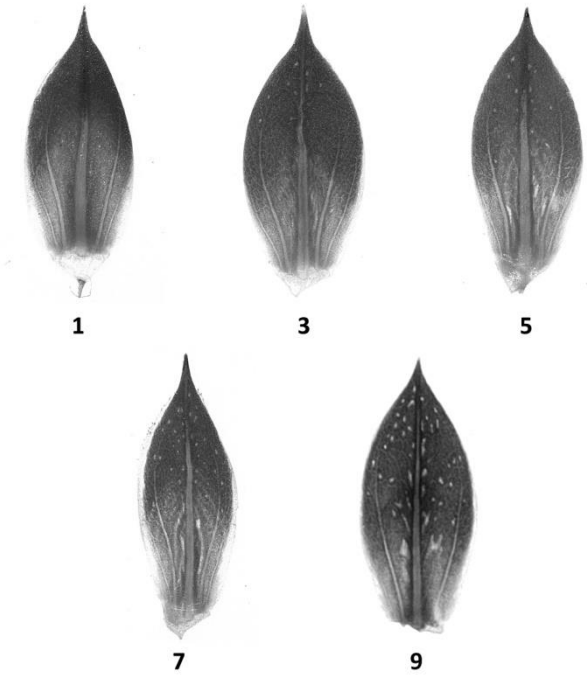
Descriptor states	
1	absent
9	present

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;
Method: Anthocyanin colour of sepal occurs at the base toward the apex part of a sepal.

3.7.36 SEPALS – dotting

Pavelek, Faberová 2000; UPOV 1995; IFDB 2006

Descriptor states	
1	very weak or absent
3	weak
5	medium
7	strong
9	very strong



Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;

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Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen. From a selected flower all flower sepals are evaluated.

3.8.37 REPRODUCTIVE ORGANS – position

Pavelek, Faberová 2000

Descriptor states	
1	anthers surrounds stigma closely
2	stigma above anthers
3	anthers surrounds stigma openly
9	other

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;
Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen.

3.8.38 REPRODUCTIVE ORGANS – style colouring

Rosenberg et al. 1978

Descriptor states	
1	white along
5	at the base coloured, follow white
9	coloured along

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;
Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen.

3.8.39 REPRODUCTIVE ORGANS – style colour

UPOV 1995; IFDB 2006; Rykova et al. 1989

Descriptor states		Reference varieties
1	white	Regina (F)
2	yellow	Natasja (F)
3	blue	Viking (F), Liflora (O)
4	dark blue	
5	pink	
6	violet	
9	other	

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;
Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen.

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3.8.40 REPRODUCTIVE ORGANS – stigma colour

Pavelek, Faberová 2000; Rosenberg et al. 1978

Descriptor states	
1	white
2	yellow
3	pink
4	redviolet
5	violet
6	light blue
7	dark blue
8	greyblue
9	greenblue

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;
Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen.

3.8.41 REPRODUCTIVE ORGANS – anther colour

Pavelek, Faberová 2000

Descriptor states		Reference varieties
1	white	
2	yellow	Hella (O)
3	blue	Viking (F)
4	grey	Opaline (F)
5	orange	
9	other	

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;

Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen. When flower opens simultaneously anthers break and pollen grains get out to the surface. Selected flowers are placed to a Petri dish in the cooling box, to avoid flower opening. Evaluation is realized under microscope. In warm and dry conditions anthers gradually break. As the first, colour of anthers is evaluated and then colour of pollen grains.

3.8.42 REPRODUCTIVE ORGANS – hue of blue anthers

Descriptor states	
1	light blue
2	dark blue
3	greenblue
4	greyblue
9	other blue

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;
Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen. When flower opens simultaneously anthers break and pollen grains get out to the surface. Selected flowers are placed to a Petri dish in the cooling box, to avoid flower opening. Evaluation is realized under microscope. In warm and dry conditions anthers gradually break. As the first, colour of anthers is evaluated and then colour of pollen grains.

3.8.43 REPRODUCTIVE ORGANS – colouring of filaments

Rosenberg et al. 1978

Descriptor states	
1	white along
5	coloured below anthers
9	other

http://dx.doi.org/10.15414/2016.9788055214849

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;
Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen.

3.8.44 REPRODUCTIVE ORGANS – filaments colour

Rykova et al. 1989

Descriptor states	
1	white
2	light blue
3	blue
4	dark blue
9	other

Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;
Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen.

3.8.45 REPRODUCTIVE ORGANS – pollen grains colour

Descriptor states	
1	yellow
2	orange
3	light blue
4	dark blue
9	other

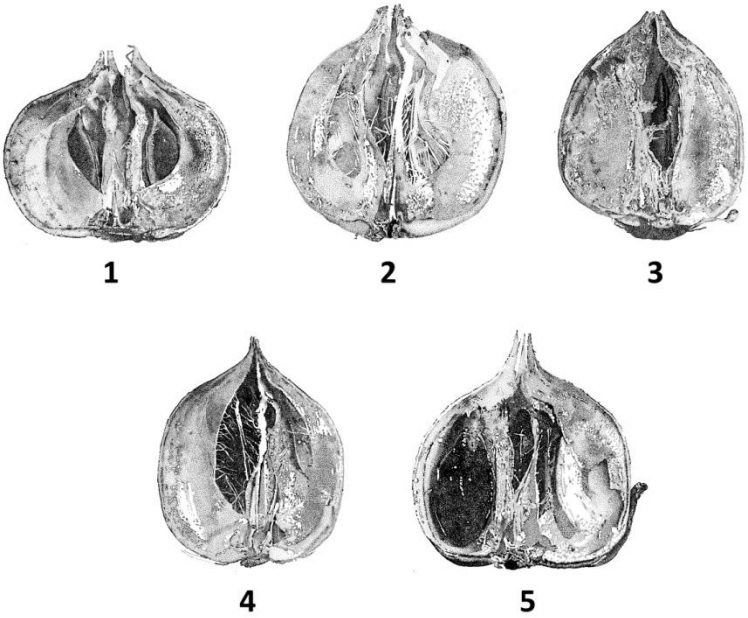
Growing stage: (O, F) = 64 – 65 (circa 40 – 50 % of field flowers) - Annex I, (Descriptors 63, 64);
Material: typical, undamaged flowers, selected from the middle part of a field;

Method: The evaluation is realized in the morning after flowers open to the final shape, during the sunny, not extremely dry weather. The flowers have typical, not pale, colour; the shape and size are not changed. The flowers suitable for evaluation are apical flowers (Descriptor 4), and flowers grown on primary lateral branches of the inflorescence. For the evaluation the most developed flowers are chosen. When flower opens simultaneously anthers break and pollen grains get out to the surface. In this time the colour of pollen is the best visible. Selected flowers are placed to a Petri dish in the cooling box, to avoid flower opening. Evaluation is realized under microscope. In warm and dry conditions anthers gradually break. As the first, colour of anthers is evaluated and then colour of pollen grains.

3.9.46 CAPSULE – shape

Pavelek, Faberová 2000

Descriptor states	
1	pressed
2	globular
3	conical
4	cylindrical
5	like cask
9	other



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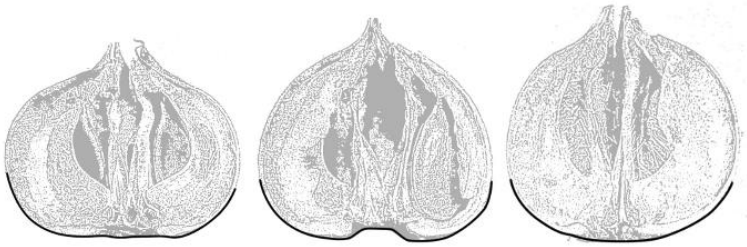
Growing stage: linseed (O) = 97 or 99 (after harvest), fiber flax (F) = 81 (after harvest) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field;
Method: In the case of epicotyl branching (Descriptor 5), the evaluation is realized on the main stem. The capsules suitable for evaluation are apical capsules (Descriptor 4), and capsules grown on primary lateral branches of the inflorescence. For the evaluation the most developed capsules are chosen.

3.9.47 CAPSULE – shape of the base

Descriptor states	
1	cut off
2	heart shaped
3	circular

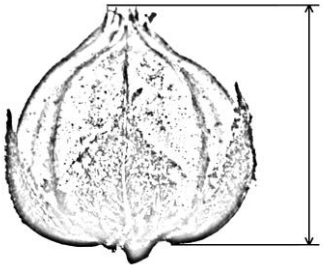


1 2 3

Growing stage: linseed (O) = 97 or 99 (after harvest), fiber flax (F) = 81 (after harvest) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field;
Method: In the case of epicotyl branching (Descriptor 5), the evaluation is realized on the main stem. The capsules suitable for evaluation are apical capsules (Descriptor 4), and capsules grown on primary lateral branches of the inflorescence. For the evaluation the most developed capsules are chosen.

3.9.48 CAPSULE – length [mm]

Descriptor states		Ranges
3	short	< 7.3
5	medium	7.3 – 9.1
7	long	> 9.1



Growing stage: linseed (O) = 97 or 99 (after harvest), fiber flax (F) = 81 (after harvest) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field, minimally 15 plants, minimally 5 capsules per plant;
Method: In the case of epicotyl branching (Descriptor 5), the evaluation is realized on the main stem. The capsules suitable for evaluation are apical capsules (Descriptor 4), and capsules grown on primary lateral branches of the inflorescence. For the evaluation the most developed capsules are chosen. The longest part of capsule is measured with accuracy to one decimal place.

3.9.49 CAPSULE – width [mm]

Descriptor states		Ranges
3	narrow	< 6.1
5	medium	6.1 – 7.3
7	wide	> 7.3

Growing stage: linseed (O) = 97 or 99 (after harvest), fiber flax (F) = 81 (after harvest) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field, minimally 15 plants, minimally 5 capsules per plant;
Method: In the case of epicotyl branching (Descriptor 5), the evaluation is realized on the main stem. The capsules suitable for evaluation are apical capsules (Descriptor 4), and capsules grown on primary lateral branches of the inflorescence. For the evaluation the most developed capsules are chosen. The widest part of capsule is measured with accuracy to one decimal place.

3.9.50 CAPSULE - surface

Descriptor states	
1	weakly ribbed
2	strongly ribbed

Growing stage: linseed (O) = 97 or 99 (after harvest), fiber flax (F) = 81 (after harvest) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field;

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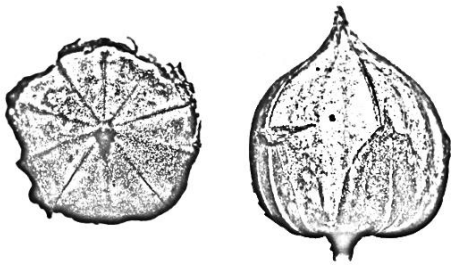
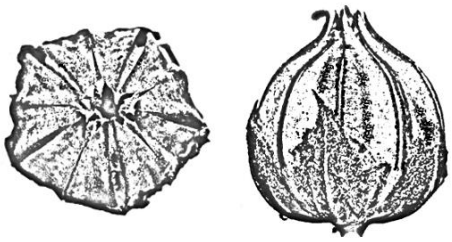


1



2

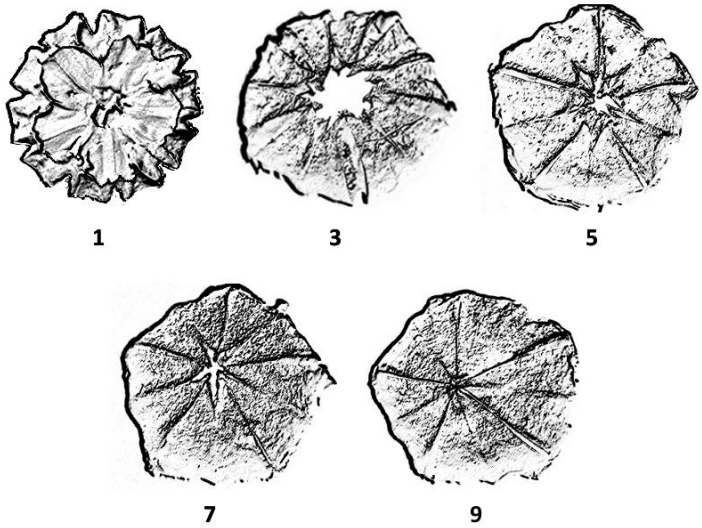
Method: In the case of epicotyl branching (Descriptor 5), the evaluation is realized on the main stem. The capsules suitable for evaluation are apical capsules (Descriptor 4), and capsules grown on primary lateral branches of the inflorescence. For the evaluation the most developed capsules are chosen.

3.9.51 CAPSULE – dehiscence

Rosenberg et al. 1978; Rykova et al. 1989; IFDB 2006

Descriptor states	
1	dehiscent, fully opened
3	dehiscent, opened
5	medium opened
7	slightly opened
9	indehiscent, tightly closed

Growing stage: linseed (O) = 97 or 99 (after harvest), fiber flax (F) = 81 (after harvest) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field;



Method: In the case of epicotyl branching (Descriptor 5), the evaluation is realized on the main stem. The capsules suitable for evaluation are apical capsules (Descriptor 4), and capsules grown on primary lateral branches of the inflorescence. For the evaluation the most developed capsules are chosen.

3.9.52 CAPSULE – intensity of anthocyanin colouring

Descriptor states	
1	without colouring
3	light
5	medium
7	strong

Growing stage: (O, F) = 75 – 79 before stage 8, when the anthocyanin colouring is still well distinguished - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field;
Method: The most frequent intensity of anthocyanin colouring (50 % of capsules in field) is selected by visual consideration.

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3.9.53 CAPSULE – ciliation of septa

UPOV 1995; IFDB 2006; Rosenberg et al. 1978

Descriptor states		Reference varieties
1	absent	Regina (F), Opaline (F)
5	absent and present	
9	present	Marina (F), Liflora (O)

Growing stage: linseed (O) = 97 or 99 (after harvest), fiber flax (F) = 81 (after harvest) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field, minimally 15 plants;
Method: In the case of epicotyl branching (Descriptor 5), the evaluation is realized on the main stem. The capsules suitable for evaluation are apical capsules (Descriptor 4), and capsules grown on primary lateral branches of the inflorescence. For the evaluation the most developed capsules are chosen. The occurrence of ciliation is evaluated on all chosen capsules by microscope.

3.9.54 CAPSULE – total number per plant [no]

Rykova et al. 1989

Descriptor states		Ranges
1	very low	< 3
3	low	3 – 5
5	medium	6 – 10
7	high	11 – 19
9	very high	> 19

Growing stage: linseed (O) = 97 or 99 (after harvest), fiber flax (F) = 81 (after harvest) - Annex I;

Material: typical, undamaged plants, selected from the middle part of a field, minimally 15 plants;
Method: All developed capsules, containing at least one developed seed, are counted. Moreover, in the case of capsules developed in consequence of cyclic flowering (Descriptor 4), because these capsules are not developed, they are not counted.

3.10.55 SEED – colour

IFDB 2006

Descriptor states		Reference varieties	RHS codes
1	yellow	Hella (O)	162 A, B
2	light brown	Ocean (O)	165 B; 166 D
3	brown	Antares (O)	165 A
4	dark brown	Viking (F), Mikael (O)	
5	blackbrown		
6	black		
7	olive		152 D
8	multicoloured		
9	other		

Growing stage: (O, F) = 99 (at the very latest half year after harvest, with developed seeds) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field, minimally 15 plants;
Method: The seeds suitable for evaluation are from apical capsules (Descriptor 4), and from capsules grown on primary lateral branches of the inflorescence. For the evaluation, seeds from the most developed capsules are chosen. Besides visual evaluation of colour, it is recommended to use the colour chart - The Royal Horticultural Society's Colour Chart (RHS).

3.10.56 SEED – width [mm]

Descriptor states		Ranges
3	narrow	< 2.80
5	medium	2.80 – 3.79
7	wide	> 3.79

Growing stage: (O, F) = 99 (at the very latest half year after harvest, with developed seeds) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field, minimally 15 plants, minimally 5 seeds per plant;

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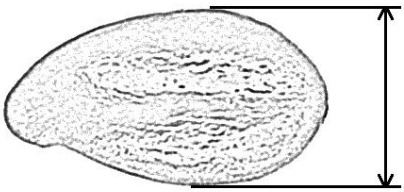
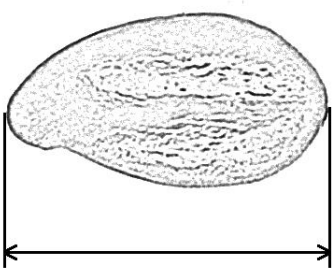


Method: The seeds suitable for evaluation are from apical capsules (Descriptor 4), and from capsules grown on primary lateral branches of the inflorescence. For the evaluation, seeds from the most developed capsules are chosen. The widest part of a seed is measured.

3.10.57 SEED – length [mm]

Descriptor states		Ranges
3	short	< 4.25
5	medium	4.25 – 5.24
7	long	> 5.24

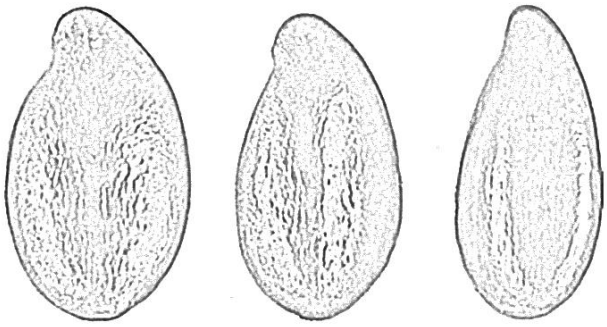


Growing stage: (O, F) = 99 (at the very latest half year after harvest, with developed seeds) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field, minimally 15 plants, minimally 5 seeds per plant;
Method: The seeds suitable for evaluation are from apical capsules (Descriptor 4), and from capsules grown on primary lateral branches of the inflorescence. For the evaluation, seeds from the most developed capsules are chosen. The longest part of a seed is measured.

3.10.58 SEED - shape

Descriptor states	
1	rounded
2	medium
3	elongated

Growing stage: (O, F) = 99 (at the very latest half year after harvest, with developed seeds) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field, minimally 15 plants;



1 2 3

Method: The seeds suitable for evaluation are from apical capsules (Descriptor 4), and from capsules grown on primary lateral branches of the inflorescence. For the evaluation, seeds from the most developed capsules are chosen.

3.10.59 SEED - weight of 1000 seeds [g]

Descriptor states		Ranges	Reference varieties
1	very low	< 4.50	Opaline (F), Jitka (F)
3	low	4.50 – 7.49	Viking (F)
5	medium	7.50 – 10.49	Amazon (O)
7	high	10.50 – 13.49	Ocean (O), Biltstar (O)
9	very high	> 13.49	

Growing stage: (O, F) = 99 (at the very latest half year after harvest, with developed seeds) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field with common density of planting (F – 2200 plants per m^2, O – 900 plants per m^2);
Method: The seeds suitable for evaluation are from apical capsules (Descriptor 4), and from capsules grown on primary lateral branches of the inflorescence. For the evaluation, seeds from the most developed capsules are chosen. Weight of 1000 seeds (WTS) is specified according to this method: from clean seeds read 2 times 500 seeds (two parallel repetitions) and weight them with accuracy to three decimal places. If the WTS for variety characterization is required, then only whole seeds are counting.
Precision of test: If the difference of both measurements is more than 10 % of their arithmetical average, the test has to be repeated. But if the difference exceeded required value even second time, then the WTS is calculated from all four repeats.

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3.10.60 SEED – weight per plant [g]

Descriptor states		Ranges
1	very low	< 0.11
3	low	0.11 – 0.54
5	medium	0.55 – 0.98
7	high	0.99 – 1.42
9	very high	> 1.42

Growing stage: (O, F) = 99 (at the very latest half year after harvest, with developed seeds) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field with common density of planting (F – 2200 plants per m^2, O – 900 plants per m^2), minimally 15 plants;
Method: From each randomly selected plant individually all developed seeds are weighted.

3.10.61 SEED – number per capsule [no]

Descriptor states		Ranges
3	low	< 7
5	medium	7 – 8
7	high	9 - 10
9	very high	> 10

Growing stage: (O, F) = 99 (at the very latest half year after harvest, with developed seeds) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field with common density of planting (F – 2200 plants per m^2, O – 900 plants per m^2), minimally 15 plants;
Method: From each randomly selected plant all capsules are counted. The number of seeds per each capsule is counted individually. The plants are polyembryonic if more than 10 seeds per capsule occur.

3.10.62 SEED – total number per plant [no]

Rykova et al. 1989

Descriptor states		Ranges
1	very low	< 20
3	low	20 – 40
5	medium	41 – 70
7	high	71 – 140
9	very high	> 140

Growing stage: (O, F) = 99 (at the very latest half year after harvest, with developed seeds) - Annex I;
Material: typical, undamaged plants, selected from the middle part of a field with common density of planting (F – 2200 plants per m^2, O – 900 plants per m^2), minimally 15 plants;
Method: From each randomly selected plant all developed seeds per plant are counted.

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4 Biological features

4.1.63 VEGETATION PERIOD – number of days from seeding to beginning of flowering [no]

UPOV 1995

Descriptor states		Ranges	Reference varieties
1	very short	< 41	
3	short	41 - 52	Mikael (O), Jitka (F)
5	medium	53 - 61	Amazon (O), Viking (F)
7	long	62 - 73	Liflora (O), Opaline (F)
9	very long	> 73	

Method: The beginning of flowering is a day when minimally 10 % of plants per field flowers (Annex I).

4.1.64 VEGETATION PERIOD – length of flowering [no]

Descriptor states		Ranges
1	very short	< 5
3	short	5 – 10
5	medium	11 – 16
7	long	17 – 22
9	very long	> 22

Method: The length of flowering is evaluated from the beginning of flowering (Descriptor 63) to a day when flowering ends. The end of flowering is a day when maximally 10 % of plants per field have open flowers (Annex I).

4.1.65 VEGETATION PERIOD – number of days from seeding to green maturity stage [no]

Descriptor states		Ranges
1	very short	< 72
3	short	72 - 87
5	medium	88 - 101
7	long	102 - 117
9	very long	> 117

Method: The beginning of green maturity stage is a day when 10 % of plants per field reach green maturity (Annex I).

4.1.66 VEGETATION PERIOD – number of days from seeding to early yellow maturity stage [no]

Descriptor states		Ranges
1	very short	< 78
3	short	78 - 95
5	medium	96 - 113
7	long	114 - 131
9	very long	> 131

Method: The beginning of early yellow maturity stage is a day when 10 % of plants per field reach early yellow maturity (Annex I).

4.1.67 VEGETATION PERIOD – number of days from seeding to yellow maturity stage (no]

Descriptor states		Ranges
1	very short	< 83
3	short	83 - 102
5	medium	103 - 121
7	long	122 - 141
9	very long	> 141

Method: The beginning of yellow maturity stage is a day when 10 % of plants per field reach yellow maturity (Annex I).

4.1.68 VEGETATION PERIOD – number of days from seeding to full maturity stage [no]

Descriptor states		Ranges
1	very short	< 88
3	short	88 – 108
5	medium	109 – 127
7	long	128 – 148
9	very long	> 148

Method: The beginning of full maturity stage is a day when 10 % of plants per field reach full maturity (Annex I).

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Uniform method for Descriptors 63 – 68: The evaluation of particular vegetation stage is realized on whole plot. The beginnings and ends of individual stages are characterized in Annex I.

4.2.69 RESISTANCE TO ABIOTIC FACTORS – lodging [%]

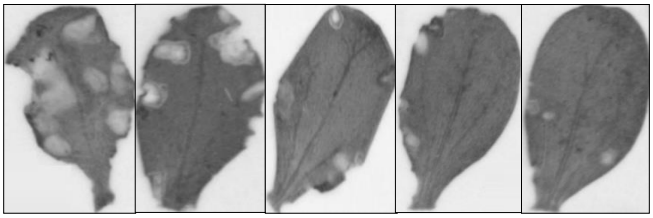
Pavelek, Faberová 2000; IFDB 2006

Descriptor states		Ranges
1	very low	> 80
3	low	80 – 61
5	medium	60 – 41
7	high	40 – 20
9	very high	< 20

Method: The resistance of plants to lodging is evaluated. The evaluation is realized three days after flood, which was accompanied with gust and/or strong wind. Percentage of lodged plants is evaluated.

4.3.70 RESISTANCE TO BIOTIC FACTORS – Pests - *Longitarsus parvulus* Schr. and *Aphthona euphorbiae* Schr. [%]

Descriptor states		Ranges
3	low	> 60
5	medium	60 – 40
7	high	< 40



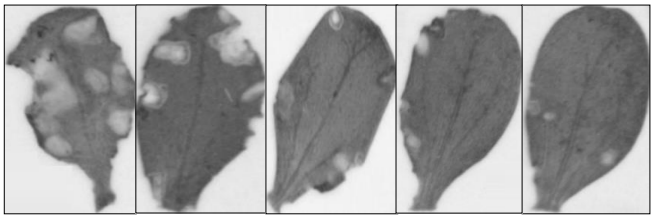
3 **5** **5** **7** **7**

photo: Vinklárková

Growing stage: Evaluate in the emergence stage (10 – 12) - Annex I.
Method: The degree of cotyledons damage is evaluated (%).

4.3.71 RESISTANCE TO BIOTIC FACTORS – Pests - *Aphthona euphorbiae* Schr. [%]

Descriptor states		Ranges
3	low	> 60
5	medium	60 – 40
7	high	< 40



3 **5** **5** **7** **7**

photo: Vinklárková

Growing stage: Evaluate in the emergence stage (10 – 12) - Annex I.
Method: The degree of cotyledons damage is evaluated (%).

4.3.72 RESISTANCE TO BIOTIC FACTORS – Pests - *Thrips linarius* Uzel. [%]

Descriptor states		Ranges
3	low	> 60
5	medium	60 – 40
7	high	< 40

Growing stage: Evaluate at the end of fast growing stage and going to bud stage (35 – 49) - Annex I.
Method: The degree of plants with damaged growing point of stem is evaluated (%).

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4.3.73 RESISTANCE TO BIOTIC FACTORS – Diseases - *Fusarium oxysporum* f. sp. *lini* [%]

IFDB 2006

Descriptor states		Ranges	Reference varieties
1	extremely low	96 – 100	Astral (O), Jupiter (O), Antares (O)
2	very low	81 – 95	
3	low	71 – 80	
4	medium low	61 – 70	Viking (F), Hermes (F), McGregor (O)
5	medium	41 – 60	
6	medium high	21 – 40	
7	high	11 – 20	
8	very high	1 – 10	Recital (O)
9	extremely high	no occurrence	

Growing stage: Evaluate at the beginning of fast growing (O, F = 32), then again at the end of green maturity stage (O, F = 79) and again at the beginning of yellow maturity stage (O, F = 81) - Annex I.

Method: The degree of damaged plants per area unit is evaluated (%).

4.3.74 RESISTANCE TO BIOTIC FACTORS – Diseases - *Colletotrichum lini* Manns et Bolley [%]

Descriptor states		Ranges
1	very low	81 – 100
3	low	61 – 80
5	medium	41 – 60
7	high	1 – 40
9	very high	no occurrence

Growing stage: Evaluate at the beginning of early yellow maturity stage (O, F = 81) - Annex I.

Method: The degree of damaged plants per area unit is evaluated (%).

4.3.75 RESISTANCE TO BIOTIC FACTORS – Diseases -- *Phoma exigua* Desm. var. *linicola* (Naum. & Vass.) Maas [%]

Descriptor states		Ranges
1	very low	81 – 100
3	low	61 – 80
5	medium	41 – 60
7	high	1 – 40
9	very high	no occurrence

Growing stage: Evaluate during emergence (O, F = 09) and then at the beginning of flowering (O, F = 61 - 63) - Annex I.
Method: The degree of damaged plants per area unit is evaluated (%).

4.3.76 RESISTANCE TO BIOTIC FACTORS – Diseases - *Alternaria linicola* Grovers & Skolko [%]

Descriptor states		Ranges
1	very low	81 – 100
3	low	61 – 80
5	medium	41 – 60
7	high	1 – 40
9	very high	no occurrence

Growing stage: Evaluate during emergence (O, F = 09) and then at the early yellow maturity stage (O, F = 81 - 91) - Annex I.
Method: The degree of damaged plants per area unit is evaluated (%).

4.3.77 RESISTANCE TO BIOTIC FACTORS – Diseases - *Polyspora lini* Laff. or *Aureobasidium pullulans* var. *lini* (Laff.) Cokke [%]

Descriptor states		Ranges
1	very low	81 – 100
3	low	61 – 80
5	medium	41 – 60
7	high	1 – 40
9	very high	no occurrence

Growing stage: the stem break and browning is evaluated during fir like stage (O, F = 19) and then stem browning at the end of green up to early yellow maturity stage (O, F = 79 - 85) - Annex I.
Method: The degree of damaged plants per area unit is evaluated (%).

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4.3.78 RESISTANCE TO BIOTIC FACTORS – Diseases - *Rhizoctonia solani* Kühn [no]

Descriptor states		Ranges	Attack characterization
1	extremely low	> 500	collective attack of plants on entire field;
2	very low	101 - 500	
3	low	71 - 100	area occurrence on some places;
4	medium low	51 -70	plants attacked in epicenters;
5	medium	31 - 50	small epicenters connects;
6	medium high	21 - 30	small epicenters occurs on field;
7	high	< 20	
8	very high	sporadic occurrence	
9	extremely high	no occurrence	

Growing stage: Evaluate during fir like stage (O, F = 19 – 31) and then during the flowering (O, F = 61 - 69) - Annex I.
Method: The number of damaged plants per area unit is evaluated.

4.3.79 RESISTANCE TO BIOTIC FACTORS – Diseases - *Thielaviopsis basicola* [%]

Descriptor states		Ranges
1	very low	81 – 100
3	low	61 – 80
5	medium	41 – 60
7	high	1 – 40
9	very high	no occurrence

Growing stage: Evaluate during fir like stage up to fast growing stage (O, F = 19 – 32) - Annex I.
Method: The degree of damaged plants per area unit is evaluated (%).

4.3.80 RESISTANCE TO BIOTIC FACTORS – Diseases - *Septoria linicola* (Speg.) Gar. [%]

Descriptor states		Ranges
1	very low	81 – 100
3	low	61 – 80
5	medium	41 – 60
7	high	1 – 40
9	very high	no occurrence

Growing stage: Evaluate at the beginning of early yellow stage up to yellow stage (O, F = 81 – 91) - Annex I.
Method: The degree of damaged plants per area unit is evaluated (%).

4.3.81 RESISTANCE TO BIOTIC FACTORS – Diseases - *Melampsora lini* (Pers.) Lev. [%]

Descriptor states		Ranges
1	very low	81 – 100
3	low	61 – 80
5	medium	41 – 60
7	high	1 – 40
9	very high	no occurrence

Growing stage: Evaluate at the capsule development stage up to green maturity stage (O, F = 71 – 79) - Annex I.
Method: The degree of damaged plants per area unit is evaluated (%).

4.3.82 RESISTANCE TO BIOTIC FACTORS – Diseases - *Oidium lini* [%]

Descriptor states		Ranges	Reference varieties
1	very low	81 – 100	Nike (F), Flanders (F)
3	low	61 – 80	
5	medium	41 – 60	McGregor (O)
7	high	1 – 40	Szegedi 30 (O),
9	very high	no occurrence	Jupiter (O)

Growing stage: Evaluate during flowering up to green maturity stage (O, F = 65 – 79) - Annex I.
Method: The degree of damaged plants per area unit is evaluated (%).

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Uniform method for Descriptors 73 – 82:

Growing stages: The evaluation is realized several times in interval of 10 – 15 days. The first time at the emergence stage, the second time at the stage of fast growing, the third time after flowering, the fourth time at the end of green maturity stage and beginning of early yellow stage (fiber flax), and the fifth time at the end of green stage and beginning of full maturity stage (linseed).

Method: The evaluation of resistance to diseases is realized according to unified classification. In the case that field is attacked by complex of many diseases, and it is hard identify individual species of diseases, then the complete attack of field is evaluated in percentage. If it is possible to identify individual species, then the field is evaluated for each particular disease according to given classification. The percentage of attacked plants per area unit is evaluated.

5 Economic traits

5.1.83 STEM - yield [%]

Pavelek, Faberová 2000

Descriptor states		Ranges
1	very low	< 65
3	low	66 – 85
5	medium	86 – 105
7	high	106 – 115
9	very high	116 - 120

Method: The evaluation of genotypes is realized on the plots with minimal area 10 m^2. In the case of planting on smaller plots, the results will be influenced by environment. The value is expressed by percentage of yield to standard cultivar. The standard cultivar is chosen by The Central Controlling and Testing Institute in Agriculture of each country and it is mentioned as a part of genotype characterization in each trait.

5.2.84 SEED – yield [% standard cultivar]

Pavelek, Faberová 2000

Descriptor states		Ranges
1	very low	< 65
3	low	65 – 85
5	medium	86 – 105
7	high	106 – 115
9	very high	> 115

Method: The evaluation of genotypes is realized on the plots with minimal area 10 m^2. In the case of planting on smaller plots, the results will be influenced by environment. The value is expressed by percentage of yield to standard cultivar. The standard cultivar is chosen by The Central Controlling and Testing Institute in Agriculture of each country and it is mentioned as a part of genotype characterization in each trait.

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5.2.85 SEED – content of fat in dry mater [% standard cultivar]

Pavelek, Faberová 2000

Descriptor states		Ranges
1	very low	< 80
3	low	80 – 90
5	medium	91 – 105
7	high	106 – 115
9	very high	> 115

Method: The value is expressed by percentage of yield to standard cultivar. The standard cultivar is chosen by The Central Controlling and Testing Institute in Agriculture of each country and it is mentioned as a part of genotype characterization in each trait.

5.2.86 SEED – yield of oil [% standard cultivar]

Pavelek, Faberová 2000

Descriptor states		Ranges
1	very low	< 70
3	low	70 – 90
5	medium	91 – 100
7	high	101 – 109
9	very high	> 109

Method: The evaluation of genotypes is realized on the plots with minimal area 10 m^2. In the case of planting on smaller plots, the results will be influenced by environment. The value is expressed by percentage of yield to standard cultivar. The standard cultivar is chosen by The Central Controlling and Testing Institute in Agriculture of each country and it is mentioned as a part of genotype characterization in each trait.

5.2.87 SEED – jodin number of oil [units]

Rykova et al. 1989

Descriptor states		Ranges
1	very low	< 161
3	low	161 – 175
5	medium	176 – 186
7	high	187 – 197
9	very high	> 197

Method: Norm accepted by each country.

5.3.88 FIBER – content in stem [% standard cultivar]

Pavelek, Faberová 2000

Descriptor states		Ranges
1	very low	< 75
3	low	75 – 90
5	medium	91 – 100
7	high	101 – 120
9	very high	> 120

Method: The evaluation of genotypes is realized on the plots with minimal area 0.5 m^2. In the case of planting on smaller plots, the results will be influenced by environment. The evaluation is realized on plants selected from middle part of field. The value is expressed by percentage of yield to standard cultivar. The standard cultivar is chosen by The Central Controlling and Testing Institute in Agriculture of each country and it is mentioned as a part of genotype characterization in each trait.

5.3.89 FIBER – yield [% standard cultivar]

Pavelek, Faberová 2000

Descriptor states		Ranges
1	very low	< 70
3	low	70 – 90
5	medium	91 – 109
7	high	110 – 125
9	very high	> 125

Method: The evaluation of genotypes is realized on the plots with minimal area 10 m^2. In the case of planting on smaller plots, the results will be influenced by environment. The evaluation is realized on plants selected from middle part of field. The value is expressed by percentage of yield to standard cultivar. The standard cultivar is chosen by The Central Controlling and Testing Institute in Agriculture of each country and it is mentioned as a part of genotype characterization in each trait.

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5.4.90 FATTY ACIDS – content of alfa-linolenic acid [%]

Descriptor states		Ranges
1	very low	< 11.1
3	low	11.1 – 24.5
5	medium	24.6 – 44.6
7	high	44.7 – 58.0
9	very high	> 58.0

5.4.91 FATTY ACIDS – content of linoleic acid [%]

Descriptor states		Ranges
1	very low	< 20.7
3	low	20.7 – 33.5
5	medium	33.6 – 52.6
7	high	52.7 – 65.4
9	very high	> 65.4

5.4.92 FATTY ACIDS – content of palmitic acid [%]

Descriptor states		Ranges
1	very low	< 3.9
3	low	3.9 – 5.2
5	medium	5.3 – 7.2
7	high	7.3 – 8.5
9	very high	> 8.5

5.4.93 FATTY ACIDS – content of stearic acid [%]

Descriptor states		Ranges
1	very low	< 1.5
3	low	1.5 – 2.6
5	medium	2.7 – 4.2
7	high	4.3 – 5.2
9	very high	> 5.2

5.4.94 FATTY ACIDS – content of oleic acid [%]

Descriptor states		Ranges
1	very low	< 14.1
3	low	14.1 – 19.0
5	medium	19.1 – 26.4
7	high	26.5 – 31.3
9	very high	> 31.3

Uniform method for Descriptors 90 to 94: Percentage of individual fatty acids in oil. The evaluation is realized by methodology for gas chromatography which is standardized for each country.

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ANNEX I FLAX GROWTH STAGES

Characterized growing stages of *Linum usitatissimum* L. were composed by unified international system BBCH (Biologische Bundesanstalt, Bundessortenamt and CHemical industry). The individual phenological stages are coded uniformly for all mono- and dicotyledons plant species (Meier 2001). Table 2 shows characterization and developing stages of specific plant parts.

Table 2 Growing stages of *Linum usitatissimum* L.

Stage BBCH	Characterization	Additional information	Stage name
0	**Germination, imbibition, emergence, embryo development**		
00	dry seed	• 1 – 3°C, period 3 - 7 days; • 5 – 8°C, period 5 - 8 days; • temperature 8°C; emergence after 10 - 15 days	**germination**
03	end of seed imbibition		
05	radicle (root) emerging from seed		
06	root elongation, root hairs development		
07 - 08	hypocotyl elongation		
09	coleoptiles breaking through soil surface	10 - 20 days after seeding (in optimal conditions)	**emergence**
1	**Leaf development (main shoot)**		
10	Elongation of hypocotyl with cotyledons; cotyledons fully developed; buds differentiation in cotyledon's axils		
11	1st pair of true leaves unfolded	stem and true leaves development; at the end of the stage the length of plant is 50 – 70 mm and about 20 true leaves are developed; period 10 – 14 days if sown in spring; in winter sawing variant it is the stage of waiting for the spring	
12 ....etc.	2nd pair of true leaves unfolded		
19	9th pair of true leaves unfolded		**fir like**
2	**Does not exist for flax**		

Stage BBCH	Characterization	Additional information		Stage name
3	**Stem elongation, shoot development (main shoot)**			
31	stem 10 % of final length	70 – 80 mm		**fir like**
32	stem 20 % of final length	beginning of fast growing; another differentiation of stem, enlargement of space between leaves enlarged; 70 % of final plant matter is developed; beginning of fiber development; length of plant 140 – 900 mm; period about 50 days after seeding		**fast growing**
33…etc.	stem 30 % of final length			
39	stem 90 % of final length			
4	**Development of harvestable vegetative plant parts (main shoot)**			
41 - 49		flower organs beginning development; period 20 – 25 days, 10 – 14 °C (hidden bud stage)		**fast growing**
5	**Inflorescence emergence (main shoot)**			
51	flower buds visible	differentiation of flower buds		**bud stage**
55	first individual flowers visible, but still closed	enlargement of buds; elongation of flower branches		
59	first flower petals visible	with finishing of flower buds differentiated; differentiation of leaves on stem ends		
6	**Flowering (main shoot)**			
61	beginning of flowering – 10 % of flowers open	plant flowering endures 3 – 5 days	at the end of bud stage flower petals are visible and after 24 – 28 hours flower opens; with flower opening pollination and consequently fertilization occurs; petals drop off	**flowering**
63	30 % of flowers open			
65	full flowering; 50 % of flowers open	flowering on the stand endures 7 – 10 days		
67	flowering ends			
69	end of flowering, visible capsules	development of fiber continues		

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Stage BBCH	Characterization	Additional information	Stage name
7	**Capsules development**		
71	capsules not reaching final size	capsules enlargement	**development of capsules**
73	first capsules reached final size	7 days after fertilization: first signs of cotyledons and roots are visible in seeds; 15 days after fertilization: seeds can germinate	
75	50 % of capsules reached final size	fiber development is finished	
77 - 79	nearly all capsules reached final size	beginning of green stage; seeds green and undeveloped; fiber contains 0.5 % of lignin; plant contains 60 % of water	**green stage**
8	**Ripening**		
81	beginning of ripening	seeds are developed, brown seeded genotypes have yellow seed colour and brown end; yellow seeded genotypes have pale yellow seed colour and darker yellow end; fiber contains 1.3 % of lignin; plants are developed for harvesting of fiber type	**early yellow stage**
9	**Senescence**		
91 – 95	capsules developed, leaves green, starting to change colour and fall	brown seeded genotypes have yellowbrown seed colour; yellow seeded genotypes have light yellow colour, and darker yellow end; plant contains 40 % of water; fiber contains 2 % of lignin	**yellow stage**
97	leaf fall ends; plants senescence	capsules brown, open on the end; seeds fully coloured; stem without leaves; fiber contains 4 % of lignin	**full maturity**
99	**Dormancy**	harvested plants and/or seeds	

ANNEX II LIST OF REFERENCE VARIETIES

The list of reference varieties represents current; a new variety is compared with (UPOV 2004). In some list of descriptors, reference varieties are used for genotypes classification. For flax genotypes, international descriptors, based on reference varieties, are followed: UPOV (1995), IFDB (2006), Community Plant Variety Office (2007). The above mentioned descriptors are used for testing of distinctness, uniformity and stability (DUS tests) of a new variety which candidates for registration (Kiewiet 2005).

Table 3 Reference varieties according to UPOV descriptors (1995) and according to descriptors in this publication

Reference varieties (UPOV (1995)		Reference varieties used in this publication	
Fiber	**Linseed**	**Fiber**	**Linseed**
Viking	Amazon	Viking	Amazon
Ariane	Mikael	**Jitka**	Mikael
Opaline	Liflora	Ariane	Liflora
Regina	Hella	**HeiYa**	**Amon**
Viola	Antarès	Regina	Hella
Belinka	Olinette	Viola	Antarès
Marina	Océan	Opaline	Olinette
	Blue Chip	Marina	Océan
	Kreola	**Natasja**	**Biltstar**
	Olive	**Hermes**	**Astral**
		Nike	**Jupiter**
		Flanders	**McGregor**
			Recital
			Szegedi 30

Legend: highlighted – varieties found in both lists; bold letters – varieties found only in one list

The two compared lists differ in some reference varieties (Table 3). Also for individual descriptors different varieties are proposed. Table 4 compares the numbers of descriptor states and the reference varieties between the UPOV (1995) descriptors and the descriptors in this publication. The UPOV descriptors were chosen for the comparison because they are the most frequently used for genotypes distinguishing.

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Table 4 The descriptors of UPOV (1995) and this publication, numbers of descriptors states and reference varieties

Descriptor name	Lists	States	Reference varieties	
			Fiber	Linseed
STEM – total length (mm)	UPOV	5	Viking	Amazon, Mikael, Liflora
	DP	7	Jitka, Viking, Ariane, HeiYa	Amazon, Mikael, Liflora, Amon,
STEM – technical length (mm)	UPOV	5	Ariane	Mikael, Amazon
	DP	7	Jitka, Viking, Ariane, HeiYa	Amazon, Mikael, Liflora, Amon,
FLOWER – corolla diameter (mm)	UPOV	3	Opaline	Mikael
	DP	5	-	-
PETALS – colour before flower opening	UPOV	5	Regina, Viking, Viola	Liflora, Hella
	DP	8	Regina, Viking, Viola	Liflora, Hella
PETALS – colour of open flower	UPOV	6	Belinka, Viking	Antarès, Liflora, Olinette, Océan
	DP	8	Regina, Viking	Antarès, Liflora, Olinette
SEPALS – dotting	UPOV	5	Regina	Amazon
	DP	5	-	-
PETALS – folding	UPOV	2	Viking	Antarès
	DP	2	-	-
REPRODUCTION ORGANS – colour of filaments	UPOV	3	Regina	Antarès, Blue Chip
	DP	7	-	-
REPRODUCTION ORGANS – colour of anther	UPOV	4	Opaline, Viking	Hella, Kreola, Olive
	DP	6	Opaline, Viking	Hella
REPRODUCTION ORGANS – colour of style	UPOV	3	Regina, Viking	Liflora
	DP	7	Regina, Viking, Natasja	Liflora
CAPSULE – size	UPOV	3	Opaline	Liflora, Mikael
	DP	3	-	-

Descriptor name	Lists	States	Reference varieties	
			Fiber	Linseed
CAPSULE – ciliation of septa	UPOV	2	Opaline, Marina	Liflora
	DP	3	Regina, Opaline, Marina	Liflora
SEED – size according to the weight of 1000 seeds (g)	UPOV	5	Opaline	Amazon, Océan
	DP	5	Opaline, Jitka, Viking	Amazon, Océan, Biltstar
SEED – colour	UPOV	5	Viking	Hella, Océan, Antarès, Mikael
	DP	9	Viking	Hella, Océan, Antarès, Mikael
VEGETATION PERIOD – number of days from sowing to beginning of flowering (no)	UPOV	3	-	Mikael, Liflora
	DP	5	Jitka, Viking, Opaline	Mikael, Liflora, Amazon
RESISTANCE TO BIOTIC FACTORS – Disease - *Fusarium oxysporum* f. sp. *Lini* (%)	UPOV	-	-	-
	DP	9	Viking, Hermes	Astral, Jupiter, Antarès, McGregor, Recital
RESISTANCE TO BIOTIC FACTORS – Disease - *Oidium lini* (%)	UPOV	-	-	-
	DP	5	Nike, Flanders	McGregor, Szegedi 30, Jupiter

Legend: DP - descriptors in this publication

The descriptors in this publication always have the same or a higher number of classification states in comparison with the UPOV descriptors that indicates that the descriptors in this publication present a wider variability of individual trait. In the Table 4 is also evident that the 5 descriptors from this publication are without the reference varieties.

The Table 5 lists the reference varieties, used in descriptors in this publication. The table shows passport data of reference varieties from Czech database EVIGEZ. The passport data provide a better orientation and varieties characterization.

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Table 5 Reference varieties and chosen passport data

ACCENAME	USETYPE	ORIGCTY	LIFETYPE	GROWTHHAB	PLOIDY
Amazon	2	GBR	1	1	2
Amon	2	CZE	1	1	2
Antares	2	FRA	1	1	2
Ariane	1	NLD	1	1	2
Astral	2	FRA	1	1	2
Biltstar	2	NLD	1	1	2
Flanders	1	HUN	1	1	2
HeiYa	1	CHN	1	1	2
Hella	2	DEU	1	1	2
Hermes	1	FRA	1	1	2
Jitka	1	CZE	1	1	2
Jupiter	2	FRA	1	1	2
Liflora	2	GBR	1	1	2
Marina	1	NLD	1	1	2
McGregor	2	CAN	1	1	2
Mikael	2	FRA	1	1	2
Natasja	1	NLD	1	1	2
Nike	1	POL	1	1	2
Ocean	2	FRA	1	1	2
Olinette	2	FRA	1	1	2
Opaline	1	FRA	1	1	2
Recital	2	FRA	1	1	2
Regina	1	NLD	1	1	2
Szegedi 30	2	HUN	1	1	2
Viking	1	FRA	1	1	2
Viola	1	NLD	1	1	2

Annotation to the table: ACCENAME - Accession name; USETYPE - Type of use: 1 flax, 2 linseed; ORIGCTY - Country of origin[3]; LIFETYPE – Type of life: 1 annual; GROWTHHAB – growth habit: 1 spring; PLOIDY – ploidy: 2 diploid (2n)

[3] The ISO 3166-1 Code List can be found at: http://unstats.un.org/unsd/methods/m49/m49alpha.htm. Country or area numerical codes added or changed are available on-line at: http://unstats.un.org/unsd/methods/m49/m49chang.htm.

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