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SEEDS HANDBOOK FOR AGRICULTURE,  
— HORTICULTURE AND FORESTRY

With a key for the identification of the important  
agricultural seeds,

(Handbuch der Samenkunde  
für  
Landwirtschaft,  
Gartenbau und Forstwirtschaft

mit einem Schlüssel zur Bestimmung der wichtigsten  
landwirtschaftlichen Samen)

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SEEDS HANDBOOK FOR AGRICULTURE,  
HORTICULTURE AND FORESTRY

With a key for the identification of the important  
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by

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Preface

Although the trade in corn seeds alone comes to some hundred million DM every year in Germany, until now there has not been any major book available which deals with the morphology and definition of seeds and fruits. Our "Agricultural Seed-Handbook," published in 1927, is long out of print. We hope therefore, that this seed handbook completely covers the subject; it contains the important types of agricultural, horticulture and forestry corn seeds, which are for sale in ordinary districts. Moreover, most corn-seeds in the market are enumerated and described.

We have recorded our seed collection over one year. The desired material has been placed at our disposal by a large number of botanical gardens in Europe as well as from seed Companies, all of which deserve our gratitude.

Our description includes only the completely grown seeds, because the development of seeds and fruits is variable every year and their shape depends on the degree of ripening. The exact description is more difficult than it might appear. It is generally known to every specialist, that the most rapid and sure determination results from comparing the natural product. This undeniable fact was raised by C. Berdemann and O. Nieser before the last war. The collection of seeds in the Governmental Institute for Applied Botany in Hamburg, which contains about 800 seeds, was arranged wrongly. The collection of seeds and fruits is a laborious and tedious matter, which is of little interest. For that reason, extensive seed collections are only encountered accordingly, apart from those in the seed control stations.

Good figures for all plants were found to be reproduced in every floristic publication, but those of seeds are rare. It is astonishing to note the general lack of knowledge among corn-seed sellers, as well as corn-seeds buyers. Only relatively few



agriculturers, horticulturers and forestry keepers are able to judge the genuineness of their purchases. Of course, not everyone should be expected to know about every seed, just as no individual can know every plant. Nevertheless it is worth noting that the knowledge about meadow-plants is remarkably better now than it was 30 years ago, which has solved many problems in the agriculture of green plants. From a better knowledge about corn seed, generally one can expect better economic progress. The best statutes concerning the trade in corn seeds lose their objective if the prerequisite-namely, knowledge about corn-seeds is lacking.

In the second part of our publication, we have rated the identification key for most agricultural seeds and their accompanying herbal forms, as we have done also for the horticulture and forestry corn-seeds. All the mentioned seeds are supplemented by a figure, through which their identification becomes easier.

The identification key is arranged according to the known method of Scheneil - Fitochen, Flora of Germany. The sign or line (-) after the number on the left side of each page are appositions, from which one only is correct in the identified seed. The number on the right side of the page after the striking sign should be followed along the left side until the seed is identified. The number mentioned immediately after the name of the seed indicates the number under which the seed has been described in the first chapter. We acknowledge the work done by Mrs Margrete Lentert ( née Vollmer) who has done the diagrams under our supervision. After some consideration, since our diagrams were represented as a photograph or as a drawing, we decided to draw the diagrams. The photograph is of course more life-like, but the drawing emphasizes the characteristics more clearly. Colored diagrams were excluded from the beginning due to higher costs, and also because they are of value only with higher magnification. A uniform magnification for all figures is not used. The scale is noted respectively beside the figure. The letters a, b, c below the figure indicate either a different representation of the same seed, or a restitution of fruit and seed. In the text we do not refer to these differences, because we assume that through their size they can be easily differentiated. The figures in the text are marked by a special sign . after the name. The numbers of the figure is identical with the number, under which the concerned seed is described in the text.

The sequence of families is arranged alphabetically not according to the system of botany. The same is used for class and species of each family. Although the significance of the system is not in question, yet identification is easier by these means. According to the nomenclature we have agreed with the usage after R. Mansfeld in Fern and Blossoming Plants of the German Empire, G. Fischer, Jena, 1940 and after L.N. Bailey Manual of Cultivated Plants, Macmillan company, New York, 1949. While we have written the



scientific name of the class in capital letters, we have written the name of the species in small letters. From the book on German plants, which gives numerous names for one class, we have mentioned only the most important. The same applies to the English names, which are italicized. The geographic relation declares only an approximate presentation on the distribution of the class.

Cordial thanks are extended to Mrs. L. Phillip, who helped us with the description of granulated legumes, and Mr. Dr. C. Schrimpff for that of the Cereal species.

Our thanks are also due to the German Agricultural Society, which gave us the opportunity to publish this work. Special thank is extended to Mr. Dr. Lais and Dr. Schneider, who gave us their total support.

In spite of all the efforts expended in such an extensive work as the present one, mistakes and gaps cannot be avoided. We are always grateful for help in correcting them.

Mohenheim, January 1955

Walther Brouwer

Adolf Stahlin



## FRUIT AND SEED

### The Fruit

The organs of blossom for the structure of fruit can be referred to, with the exception of stamens as well as adjacent parts. For example, the blossom-axle or perianth or even front and upper carpels may take part in the fruit core. Frequently, different organs near to the blossom share in the dissemination of the fruit. By fruit, according to Beck V. Menagetta (Handbook of Natural Science 2nd Ed. Vol IV, p. 402, Jena) we mean all the metamorphosed organs of the plant, which enclose the seeds until maturation, then disseminate separate from the seed. Normally the fertilization precedes the formation of the fruit. But in an asexual way embryos can originate in the placentae, and their further development also stimulate the formation of the fruit. Such behavior is known as apomixis.

In the fruit, the pericarp and the seed (semen) can be differentiated. The pericarp, which surrounds the germ, can be of different shapes. After successful fertilization, the hilum and most of the rest of the blossom parts (Pistil, Calyx, perianth) dry off, to the extent that they are not important in the dissemination of the fruit. The ovary will be a fruit. In order to make a place for the growing germs, the cells of the pericarp multiply and increase in size, thus forming the fruit core. In the mature pericarp, two or three layers can be differentiated; the exocarp, the endocarp (the inner epidermis of the pericarp) and the mesocarp, which is found between the two other layers and is formed from vascular bundles leading to the parenchyma. The hard or stone tissue (Sclerocarpium) originates from the pericarp at maturity i.e compact, from sclerotic structures, mechanical tissue, or the soft tissue or fruit pulp (Sarcocarpium) i.e. a soft, not woody parenchyma, which contains the fluids and nutritive substances, or also a dry layer (xerocarpium) i.e dry, empty cellular layers. Generally the sclerocarp is only formed when the pericarp takes charge of germ protection, and only if it is lined with a thin germ busk (nut). The sarcocarp is formed in the pulpy fruits, whereby the germ is furnished with a compact germ busk (berry).

Moreover, different changes can occur on the surface of the fruit, eg. formation of hairs, setas, prickles etc.

To date, there is no generally recognized classification of fruits in a fruit system. To the extent that these are established, they manifest great differences. The followings are the most important fruit forms:

#### I Fruits of Angiospermae

##### 1- Single fruits

##### A. Secede fruits

##### B. Disseminated or dehiscent fruits





- 2- Collective fruit (syncarp)
- 3- Fruit conjunctions

## II. Fruits and fruit-like seeds of Gymnospermae

- 1- Fruits of Gymnospermae
- 2- Fruit-like seeds of Gymnospermae.

### Fruits of Angiospermae

#### 1- Single fruits

#### A- Secede fruits (Fructus secedentes)

a) Indehiscent fruit (Fructus indehiscens). The indehiscent fruits are formed from one or more carpels and are mostly one-seeded. They do not open at maturity, and fall off, as a separate disseminating unit. They are enclosed in all or parts of the pericarp.

aa) The nut (Nux) is one-seeded (Fig. I, 1,2). The seed lies freely inside the closed perisperm or seed-case. The pericarp is leathery, woody, hard - usually the hardness of bone - and fragile. The shape of the nut is manifold. Different transitions - flat to spherical and to longitudinally stretched forms occur; commonly, the fruit appears round (Fig. I, 3) or one-sided and winged, or with dorsal or diagonal wings. Also, appendages are common. Villous, crinite (Fig I, 4), prickly, spiny fruits occur - those with a barb; sometimes, the pistil remains, hardens and serves for dissemination by animals and wind. Commonly, the pistil will be metamorphosed to a feather-like appendix (eg. Anemone spp.). Likewise, the upper carpels and the metamorphosed perianth are commonly connected with the fruit (Fig. I, 5). The calyx is sometimes metamorphosed to a spring corolla or to wing. Likewise, the bracts may appear to be in contact with the nut; e.g., the bracts unite with the carex and form + distended utricle, its tip ends with two tines. Sometimes the bracts surrounding the small nut are provided with crenatures & tines. Also, we find the union of the nut with a deck squama and two bracts. At the base of the nut in other species a + woody calyx (cupula) is formed as in the fruit of oak - the acorn (glans). The calyx shows a scaly axile organ, which has differently shaped squamas. The nut fruit can be found, for example, in the Boraginaceae, cheupodiaceae, Polygonaceae, Ranunculaceae, cyperaceae and others.

bb) Achene or small nut (Fig. I, 6). In this, the testa and the pericarp are fused together. It is considered as a subclass of the nut. The achene commonly has a hairy calyx (pappus) and forms a perianth, which can be of different shapes (Fig. I, 7,8); it appears as single or double hair crown, has a shape of pinnate hairs or barb, or also as a crown or squama.



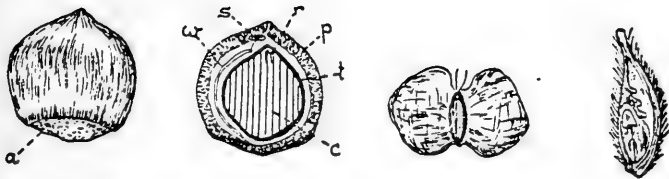


Diagram 1      Diagram 2      Diagram 3      Diagram 4

Fig. 1

Diagram 1. Nut of *corylus avellana* (after Strasburger)

a = site of cleavage

Diagram 2. Nut of *corylus avellana*, diagrammatic long section (after Strasburger) P = pericarp W = bundles leading to the ovaries. s = rudimentary ovary, t = seed husk c = nuclear lamina r = Hypocotyl.

Diagram 3. Winged nut from *Betula* sp. (Handbook of Natural Science)

Diagram 4. Crinite fruit from *Anemone nemorosa* longitudinal section (after Hegi).

Frequently, the upper end of achene is elongated in a + long beak, which bears a parachute-like pappus. Some fruits are differently grooved a provided with prickles or hooks, while others are winged. Achenes are well-developed in compositae, Dipsacaceae, etc.

cc) Another subclass of indehiscent fruits is the karyopse, i.e., permanent grass fruits (Fig. 1, 9). The testa is fused with pericarp and the latter is usually fused also with the glumes. The pericarp is membranous. The one-seeded indehiscent fruits is usually enveloped totally by the upper and lower glumes, which fall down together with the fruit after maturation. In relatively few species, the fruit falls from the glume after maturation - (eg. rye, corn). The glumes commonly bear a + long, smooth or rough awns, which represent the elongated flöret. The karyopse is the fruit of Gramineae.

dd) The stone fruit (Drupa) is single-seeded (Fig. 1, 10). The pericarp is composed of a pulpy, juicy external part (Exocarp) and a compact and hard internal part, which is known as the stone (putamen). The typical form of stone fruits (cherry, plum, walnut, etc.) is composed of a fruit membrane, which usually contains one seed, or in exceptional cases two seeds (phillipine of



hazelnut, almond). The exocarp may be thick, pulpy, juicy (plum, peach), it may also be unpalatable, containing tannin (walenut) or it may be very thin and dry (almond). The stones of the fruit take different shapes. Their wall is hard and woody (peach, cherry) or parchment-like, and thin (apple, pear). In the Pomoideae, the fruit stone is surrounded by an endo - and mesocarp and by several cores (Antrum).

The multiple leafy stone fruits contain one or even two to nine or more stones.

ee) The Berry (Bacca). In contrast to the stone fruits, the whole fruit pulp (pericarp), which is formed from meso- and endocarp, is pulpy, juicy, pappy or spongy (Fig. I, 11,12). The fruit pulp of wine berry, gooseberry, red-currant etc. is especially rich in sugar. The exocarp is usually delicate: (Cucumis, Solanum, Lycopersicon Ribes, Vaccinium, Vitis) and thin; however, sometimes it forms a sort of rind with external parts of the mesocarp. This rind may have a firmer property (eg pumpkin). In the orange, lemon and others, the spongy pericarp encloses the numerous fruit divisions, which are filled with juicy fruit pulp.



Diagram 5      Diagram 6      Diagram 7      Diagram 8

Fig. 1

- Diagram 5 = Nut with flying squama from *cappinus betulus* (Handbook of Natural science)
- Diagram 6 = Achene from *Helianthus annuus* (after Strasburger)
- Diagram 7 = Achene with pappus from *Lactuca virosa* (after Strasburger)
- Diagram 8 = Achene with pinnate pappus of *Valeriana dioica* (after Handbook of Natural Science).



b) The segmented fruit (Monocarpium) is one fruit formed from a petal, which breaks down diagonally into several one-seeded segments. The pericarp is hard and dry: These include:

aa) The loment (Lomentum)

bb) The crasped (Craspedium)

aa) In the loment all segments are of the same shape (Fig. II, 1), irrespective of the bottom segment and the last fixed one. If no seeds are formed in one segment, then it remains flat and smaller than the others. The shape of the segments is changeable. Some appear spherical or barrel-shaped (Sarradella), while others are horseshoe-shaped (horseshoe clover) or crescent-shaped, commonly, appendages are present in the form of setas, prickles or hooks. The last fixed segment shows, not infrequently, a spiny or hooked pistil (Serradella) or a peculiar wing.

bb) In the crasped, the fruit breaks down diagonally into one-seeded parts, which fall out from the remaining envelope (Replum), which is formed from ventral & dorsal suture (eg Mimosa (Fig II, 2)).

Prickles or hooks appear as appendages on the replum.

c) The brittle or fragile fruits (Meri-carpuim) consist of two or rarely more, petals. They break down into one-seeded parts, which represents parts of petals. One differentiates:

aa) The closet (Eremus)

bb) The segmented pod (Bilomentum)

aa) In the closet every petal is divided by a false septum into two small one-seeded nuts (closets), or the petals are split up by a + transverse constrictions into several closets, which lie in two to three superimposed layers (eg Nolanaceae). Usually four closets are present, rarely two or more than four. The surface is of different shapes: warty, setiform, barbed, excavated, reticular. Cups or wings with serrated or with hooked edges are formed through the widening of the closet borders.

Very commonly, the calyx remains and establishes different ways for dessimination.





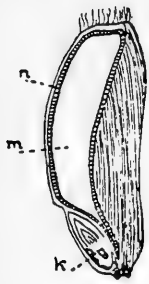


Diagram 9      Diagram 10      Diagram 11      Diagram 12

Fig. 1

Diagram 9 = Caryopse from *Triticum aestivum*, longitudinal section (after Nowack-Optiz). k = embryo, m = endosperm, n = alveolar layer.

Diagram 10= Stone fruit of *Prunus avium*, longitudinal section (after Strasburger)

Diagram 11= Berry of *Ribes grossularia* (Handbook of Natural science)

Diagram 12= Berry of *Ribes grossularia*, transverse section (Handbook of Natural Science).

bb) The segmented pod breaks down transversally into one-seeded closed segments, which represent the sections of two petals. They appear only in Cruciferae (eg *Raphanus*, *Cakile*, *Rapistrum*).

d) The dehiscent fruit (*Schizocarpium*) consists of two or more (20-50) carpels (Fig. II, 5, 6, 7, 8). They break down into isolated carpels; commonly, a central pile remains - the fruit bearer or fruit holder (*carpophorum*) from which the dehiscent fruits are detached. The dehiscent fruits are mostly one-seeded. The detachment occurs either by the breaking of the syncarpium in isolated nuts (eg. *Galium*, *Euphorbia*), or a Central pile remains over (eg. *Geraniaceae*, *Umbelliferae*, *Acer*).

Appendages are common. Formation of wings occurs (eg. maple), in which there is a  $\pm$  bigger wing on the dorsal surface of each dehiscent fruit.

The surface varies in shape: reticulated, excavated, provided with setas and prickles or with hair tufts.

Dehiscent fruit is found particularly in the *Umbelliferae* and *Rubiaceae*. It is designated as a double achene or suspended fruit. The detachment of the one-seeded dehiscent fruits occurs mostly from a central pile, which divides in a descending manner. The central pile may also be absent (eg. *Bifora*, *Galium*).





Diagram 1

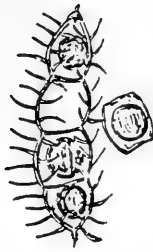


Diagram 2

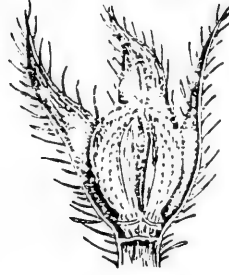


Diagram 3



Diagram 4



Diagram 5

Fig. 2

Diagram 1: Loment of *Ornithopus sativus* (after Strasburger)

Diagram 2: Surrounding capsule of *Mimosa pudica* (after Handbook of natural Science)

Diagram 3: Brittle fruit with closets of *Borago officinalis* (Handbook of Natural Science).

Diagram 4: Pods of *Raphanus raphanistrum* (Handbook of Natural Science).

Diagram 5: Dihiscent fruit of *Galium aparine* (after Hegi).

B- Disseminating Fruits (*Fructus disseminates*) are those which open so that the seeds disseminate separately. According to the number of carpels and the type of dissemination we can differentiate:

- a) Follicular fruits (*Follicarpuim*)
  - aa) The follicle (*folliculus*)
  - bb) The capsules (*Legumen*)
  - cc) The lalinated pod (*stomatocarpuim*)
  - dd) The utricule pod (*Utriculus*)
- b) Capsular fruit (*Capsula*)
  - aa) The fissured capsule
  - bb) The operculated capsule
  - cc) The pored capsule
  - dd) The utricule capsule.

a) The follicular fruit (Fig. III, 1,2) consists only of one carpel, which opens out from itself, allowing the seeds to dessiminate. This includes:



aa) The follicle. It is mostly oval. (eg. *Caltha*) or elongated (eg. *Asclepiadaceae*), commonly flattened laterally and relatively short. It opens with a fissure through one part or along the whole length. The fissure is found at the ventral suture (*Sutura dorsalis*).

The pericarp is usually dry, cuticular or leathery, rarely pulpy or juicy. The follicle is one-celled and mostly contains numerous seeds, which after opening lie at the periphery of the follicle (eg. *Delphinium*). Rarely, the follicle contains only one seed (eg. *Illicium*, *Magnolia*).

bb) The capsules (Fig. III, 3.4.5.6) develops also from one carpel. It opens through the whole length at the dorsal and ventral suture. It is usually one-celled. The size of the capsule differs, usually according to the number and size of seeds inside it. Its shape is elongated, ellipsoid,  $\pm$  compressed, winged, distended, straight, curved, spiral, or of other shapes. At maturation it opens from itself, from the tip towards the base at the dorsal and ventral sutures.



Diagram 6



Diagram 7



Diagram 8

Diagram 6: Dehiscent fruit with central pile of *Geranium* sp.  
(after Strasburger)

Diagram 7: Double achenes of *Carum carvi* (after Hegi)

Diagram 8: Dehiscent fruit of *Malva silvestris* (after Strasburger).

Sometimes, only the upper part of the capsule splits, sometimes it breaks off suddenly or the clacks rolls and throws the seeds outside. At the time of maturation the pericarp is usually cuticular and dry. By a secondary partition or by a grooved wrinkle of the dorsal suture, the capsule is divided into two parts.



Appendages are common. Beak, hook, hairs, setas are often encountered.

Small capsules fall down together with the calyx, through which the mechanism of dissemination is supported; mostly, the tips of the calyx are feathery or the calyx is distended and metamorphosed to a winged calyx.

The capsule is the typical fruit form of most of the leguminosae and prateaceae.

cc) The labiated pod is a monocarpium, which bursts diagonally with a fissure, whereby the dry pericarp either opens at the labiate (eg. *Jeffersonia* of the *Berberidaceae*), or the upper part is thrown as an operculum (eg., *Leontice* sp. of the same family).

dd) The utricule pod (Fig. II, 7) opens irregularly. Sometimes the pericarp cracks irregularly in a downward direction between the sutures, whereby two clacks may develop (*Epimedium*) or it ruptures with perforations at the tip (*Epimedium*), or it opens with unequal clacks.



Diagram 1



Diagram 2



Diagram 3



Diagram 4



Diagram 5



Diagram 6



Diagram 7

Fig. 3

(Fig. continued on the following page)





- Diagram 1: Follicular fruit of *Delphinium consolida* (Handbook of Natural Science)
- Diagram 2: Follicular fruit of *Delphinium consolida*, diagrammatic cross section (Handbook of Nat. Science)
- Diagram 3: Capsule of *Pisum sativum* (after Hegi)
- Diagram 4: Winged capsule of *Lotus tetragonolobus* (Handbook of Nat. Science)
- Diagram 5: Helical twisted capsule of *Medicago denticulata*, top view (Handbook of Nat. Science)
- Diagram 6: Helical twisted capsule of *Medicago orbicularis*, side view (Handbook of Nat. Science)
- Diagram 7: Utricle pod of *Epimedium alpinum* (after Hegi).

b) Capsular fruit is formed from a syncarpium, which opens in different manners. After opening the capsular fruit can be divided as follows:

aa) In the fissured capsule (*Capsula*, Fig. IV, 1) the ovary is formed from two or more carpels. According to the number of divisions, they are noted as, one, two or multiple-locus. A one-mono-locus capsule can be found in *Orchis*, *Viola*, *primula*, a two-locus in *verbascum*, *gentiana*, a three-locus in *Libium*, *iris* etc, four-locus in *Oenothera*, *Euonymus*, a five-locus in *Oxalis*, *Impatiens*, *Rhododendron*, and a six locus in *Aristolachia*. The division is not always complete; sometimes it occurs through placental proliferation. Thus the capsule of *cruciferae* becomes a two-locus capsule by a placental septum. In the papaver, the mono-locus capsule is not completely divided by segmented projecting placentae.

The pericarp at maturation is usually dry and, leathery; rarely pulpy and juicy.

The capsule opens longitudinally by a fissure, and cracks into two or more clacks (*valvae*), which separate totally from each other or separate after a short distance. If the detachment occurs at the base, the capsule breaks totally into clacks, which fall off after the dissemination of seeds. If the clacks are detached slightly downwards, so that the opening is incomplete, the capsule opens and shows times corresponds to the number of carpels (*Karpelle*), from which the avary originates. According to the art of cracking the capsules are divided into:

aa 1) Fissured locus (*C. loculicida*), when every division opens at the dorsal suture with a fissure (Fig. IV, 2) eg. *viola*.

aa 2) Septi-fragile (*C. septifraga*), when they crack at the septum, whereby the fissure can lie more to the inside, so that the central pile remains with the axillary placentae and the internal parts of the septum (Fig. IV, 3), as in some *Ericaceae*, or the septum breaks at the external wall, as in many *Bignoniaceae* (Fig. IV, 4).





Diagram 1

Diagram 2

Diagram 3

Diagram 4

Fig. 4

Diagram 1: Fissured capsule of *Fritillaria imperialis*  
Handbook of Nat. Science)

Diagram 2: Transverse section of fissured locus capsule,  
diagrammatic (Handbook of Nat. Science)

Diagram 3 & 4: Transverse section of septi-fragile capsule,  
diagrammatic (After Handbook of Nat. Science)

aa 3) Septi-fissured (*C. septicida*), when the carpels break and crack at the suture, so that the septa become separated (Fig. IV, 5) eg., in *Hypericum*, *Digitalis*.

aa 4) Ventri-fissured (*C. venticida*), when the carpels open at the ventral suture. This occurs in two ways.

a) By a fissure, through which the placentae become divided (one-called Capsule) (Fig. IV, 6) eg., *Gentiana*, and capsular pod (Fig. IV, 7) eg *Calchicum*, *Dictamnus*, *Helleboms*, *Saxifraga*);

B) By two fissures, which separate the undivided placentae from the clacks. Thereby the placentae form a central pile (Fig. IV, 8), which are detached with the seeds from the clacks (e.g., *Apacynaceae*). If the placentae are marginal, then the pod will be formed (*Siliqua*, Fig. V, 1). This originates from two carpels with two clacks, which are separated from the remained septum. A false septum may be present between the placental casement (*Replum*). The pod become two-locus. The seeds are fixed at both sides of the septum. The fruits are opened at maturation, at both sutures and in an upward direction. The two fissures separate the placental casement from the clacks; between them, the false septum is stretched. If the pod is short, the length is not more than three times the width, and is called a small pod. (*Silicula*, Dig. V, 2, 3). Usually the pod is compressed laterally and has flat or arched clacks. Sometimes the clacks are rolled quickly in an upward direction and thus cause the seeds to face outwards. Moreover, there are pods, by which



the frames are narrow and the clacks at the dorsal surface are edged or winged. Appendages are rare. This includes most of Cruciferae.

aa 5) Double fissured (*C. biscida*). The capsule breaks in combination of different manners of opening. A fissured-locus and septi-fragile opening way can be found eg. in *Epilolium*, *Erica*, *Tecoma*, also in *Datura* (Fig. V, 4). To this belongs the capsule of *Impatiens*, in which the detached clacks roll quickly, separate themselves from the broken central pile and force the seeds to the outside (Fig. V, 5). The locus and septum division are found (Fig. V. 6) in numerous *Scrophulariaceae* and *Rubiaceae* etc., as are septi-fissured and septi-fragile in *Rhododendron*.

bb) Another special case is the operculated capsule (*Pyxidum*) i.e., the formed capsule, which breaks with a sharp and transversally cut operculum. It originates from two or more carpels. It is mono- or multi-locus. Usually the pericarp is thin and dry.



Diagram 5

Diagram 6

Diagram 7

Diagram 8

Fig. 4

Diagram 5: Transverse section of septi-fissured capsule, diagrammatic (Handbook of Nat. Science)

Diagram 6 & 7: Transverse section of ventri-fissured capsule, diagrammatic (Handbook of Nat. Science)

Diagram 8: Transverse section of a fragile-placental capsule (Handbook of Nat. Science).

Mono-locus: *Amaranthus*, *Angallis* et (Fig. V, 7) two locus; *Hyoscyamus* *plantago* etc. Multi-locus, *Lecythis* etc.

cc) In the pored capsule (*C. forata*) the opening occurs in the pericarp of the numerous carpels ovaries at specific parts, at which originate sharp circular + small holes, through which the seeds disseminate.





Diagram 1



Diagram 2



Diagram 3



Diagram 4



Diagram 5



Diagram 6



Diagram 7

Fig. 5

- Diagram 1: Pod of *Cheiranthus cheiri* (Handbook of Nat. Science)  
 Diagram 2: Small pod of *Lunaria annua* (Handbook of Nat. Science)  
 Diagram 3: Small pod of *Capsella bursa-pastoris* (Handbook of Nat. Science)  
 Diagram 4: Transverse section of fissured locus and septi-fissured capsule, diagrammatic (Handbook of Nat. Science)  
 Diagram 5: Exploded capsule of *Impatiens balsamina* (Handbook of Nat. Science)  
 Diagram 6: Transverse section of a fissured-locus and septi-fissured capsule, diagrammatic (Handbook of Nat. Science)  
 Diagram 7: Operculated capsule of *Angallis arvensis* (Handbook of Nat. Science).





Rarely, one pore only is present. The pores or holes originate in different ways at particular parts. Accordingly, many different forms can be differentiated:

- Papaver-capsule (Fig. VI 1,2)
- Reseda-capsule (Fig. VI, 3)
- Campanula-capsule (Fig. VI, 4)
- Antirrhinum-capsule (Fig. VI, 5)
- Ecballium-capsule (Fig. VI, 6) etc.

dd) The utricle capsule (*Sacellus*, *C. rumpens*) opens irregularly. Either the capsular wall breaks totally into irregular pieces (eg. *chenopodium* etc.), or the capsular wall falls out irregularly between the ribbed core nerves (eg. *Jussiaena* and *Onagraceae*) or the pericarp laterates in thread-like parts (eg. *Illecebrum*). Rarely, the juicy pericarp explodes as in *Cyclanthera* exploding.

Appendages occur relatively rarely in capsular fruits. More commonly, the calyx remains on the capsule at maturation or serves as a shaker for the seeds (eg. *Hyoscyamus* and numerous *Scrophulariaceae*). Wings are found on the capsule; prickles, spiny continuation can be also found (eg. *Aesculus*, *Datura*).

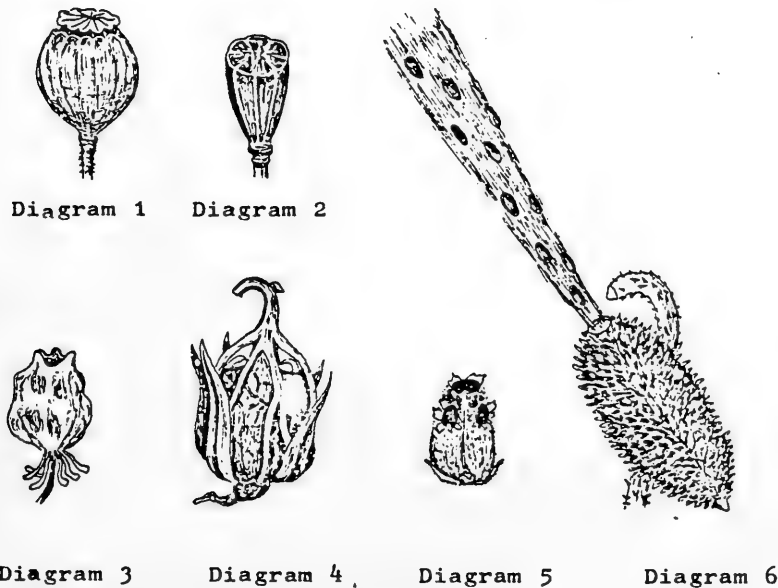


Fig. 6

(Fig. continued on the following page)



- Diagram 1: Pored capsule of papaver species (After Hegi)  
 Diagram 2: Pored capsule of papaver species transverse section (After Hegi)  
 Diagram 3: Pored capsule of Reseda odorata (Handbook of Natural Science)  
 Diagram 4: Pored capsule of Campanula rapunculoides (Handbook of Natural Science)  
 Diagram 5: Pored capsule of Antirrhinum maius (Handbook of Natural Science)  
 Diagram 6: Exploded capsule of Ecballium elaterium (Handbook of Natural Science).

## 2- Collective Fruits (syncarp) (Fructus connati)

In the collective fruits, single fruits or syncarps of two or four blossoms coalesce with the pericarp, to become a dissemination unit. According to the characteristics of the single fruit one can differentiate besides the rarely present collective disseminating fruit, the following:

- A- The collective berry
- B- The collective stone-fruit.

A. The collective berry (*Bacca connata*) is formed by the coalescence of two or more berries (Fig. VII, 1). The simplest form is found in the double berries (*Bibacca*) eg., that of *Lonicera*, where the fusion of both berries is complete, so that an almost spherical berry is formed. The fruit pulp may increase in the presence of appendages, eg., in *Ananas* (pineapple).

B. In the collective stone-fruits (*Drupae connata*, Fig. VII, 2), two or more stone-fruits of one or more blossoms coalesce with the pericarp and form a dissemination unit. In raspberries and blackberries, the single stone-fruits coalesce into a collective fruit, which become separated from the plant without cleavage. Although the wall of the stone in the apple fruit is parchment-like and thin, the sklerenchymester are considered as a transition to the hard stone of pear.

## 3- Fruit conjunction (Fructus conjuncti)

In these, the fruits of one or more blossoms are detached from the plant with remaining appendages (axial parts, perianth, upper carpels), which act as a self-supporting propagation unit. One may differentiate:

- A- Nut conjunction
- B- Berry conjunction
- C- Stonefruit conjunction



A. Nut conjunction (*Nuces conjunctae*) are formed by means of pulpy or dry appendages. In the first one, the nuts of the single blossom are supported from the blossom base (hypanthium), which become pulpy. The beads of genus *Rosa* stand free in the cavity of the cupshaped blossom base (haw) (Fig. VIII, 1,2).



Diagram 1

Diagram 2

Diagram 3

Fig. 7

Diagram 1: Double berry of *Lonicera xylosteum* (After Hegi)

Diagram 2: Collective stone-fruit of *Rubus* species (After Handbook of Natural Science)

Diagram 3: Multi-Carpels stone-fruit of *Malus silvestris*, diagrammatic longitudinal section (After Strasburger).

In strawberry, the blossom base becomes arched and Cone-shaped and forms a sweet fruit pulp; on their surface, the individual heads stick (Fig. VIII, 3,4). The beads of numerous blossoms are also supported by pulpy appendages. In the fig fruit (*Syconium*), the pulpy inflorescence axle forms a cavity in which the beads are enclosed. In the mulberry (*Morus*), the beads are enclosed in the perianth leaves, which form a sweet fruit-pulp (Fig. VIII, 5). The perianths are + compact and coalesce with each other, forming the complete deciduous mulberry.

The same applies to dry nut conjunction, in which the nuts of each individual blossom or numerous blossoms are united by dry axle organs or petals. To this belongs, for example, the nut conjunction of lime blossom (*Tilia*), which is provided with a bearing leaf, which acts as a wing (flying apparatus) (Fig. VIII,6). It can be also the squama sheath, which unites the nuts of several blossoms. To this belong, eg., the nuts of copper beech (Fig. VIII, 7) and chestnut (*castanea*), which is enclosed by a prickly calyx; moreover, this includes the fruit conjunction of burdock (*Xanthium*), in which the top squamas fuse and usually enclose two nuts.



B- Berry conjunction (*Baccae conjunctae*) is rare. Here, the pulpy hypanthium surrounds many multiple-seeded parts (eg., by *Eupomatiaceae* from New Guinea and Eastern Australia).

C- Stone fruit conjunction (*Durpae conjunctae*) is also rare. The wigtree (*Rhus cotinus* (Fig. VIII, 8)) possesses blossom panicles; its twigs are elongated and bear stone fruit as in the dehiscent fruits, which retain pinnate hairs.

## II Fruits and Fruit-like seeds of Gymnospermae

### 1- Fruits of Gymnospermae

The most common fruit of Gymnospermae is the fruit of the hop (*Conus* (Fig. IX, 1) which originates from numerous screw-shaped, oppositely arranged or angular squamas. On the upper and lower side or in the axle, these show winged or unwinged seeds, eg. *coniferae*. The size of the cone varies widely.

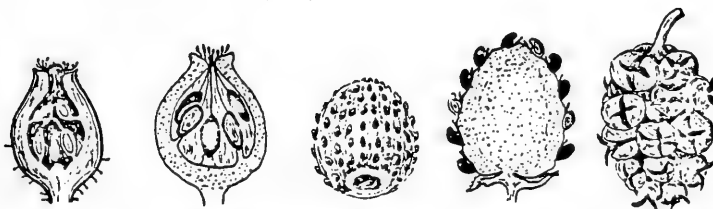


Diagram 1 Diagram 2 Diagram 3 Diagram 4 Diagram 5

Fig. 8

- Diagram 1: Pulpy nut conjunction (haw) of *Rosa* species (Handbook of Natural Science)  
Diagram 2: Pulpy nut conjunction of *Rosa* species diagrammatic (After Strasburger)  
Diagram 3: Pulpy nut conjunction of *Fragaria vesca* (Handbook of Natural Science)  
Diagram 4: Pulpy nut conjunction of *Fragaria vesca* (After Strasburger)  
Diagram 5: Berry-like fruit conjunction of *Morus alba* (Handbook of Natural Science).

The smallest are hardly 3 mm in size, while the largest have weigh more than 1 kg. The squamas of the cone are covered in a domed manner, or their ends become thickened after pallination and then remain closed until maturation, during which they are closed and lie densely. The closure is accelerated by matches or hair formation. The cones open after the drying of tissue





parts of the squamas, which become highly contracted. They break off from each other; the seeds become free and slip from the attached calyx. In the straight cone-secede the squamas fall down from the spindle.

Also for secede fruits, a woody calyx may be formed. The cones-secede are tightly closed. The seeds become free through the gnawing of various animals.

Through appendages the berry cone (Galbulus) originates characteristic for instance, for Juniperus. Here, the carpels coalesce after pollination, become pulpy and form the berry (Fig. IX, 2).

## 2. Fruit-like seeds of Gymnospermae

In many Gymnospermae, the seed becomes fruit-like. The similarity of such seeds is increased through the formation of pulpy accessories. In *Taxus* (Fig. IX, 3) the small nut-shaped seed is surrounded by a cup, which corresponds to the Arillus.

The stone-fruits are similar to the seeds of Gniko, cycas and others. Here the seed-case (pericarpium) is differentiated to a pulpy outer mantle, which corresponds to that of the fruit pulp of the stone fruit (exotesta), in an internal woody stony layer (Mesotesta, that corresponds to the pernel of the stone-fruit) and in a delicate, more internal layer (Endotesta), which surrounds the nucleus and is like a testa.

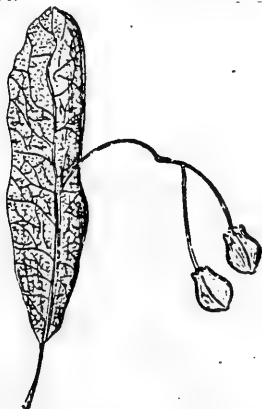


Diagram 6



Diagram 7



Diagram 8

Fig. 8

(Fig. continued on the following page)



- Diagram 6: Nut conjunction with supporting leaf as a wing of *Tilia platyphyllos*  
 Diagram 7: Fruit conjunction through squamous sheath of *Fagus silvatica* (Handbook of Natural Science)  
 Diagram 8: Stone fruit-conjunction (part) of *Rhus cotinus* (after Hegi).

### The Seed

The seed (semen) serves for normal reproduction and represents the not yet developed plant. Its most important part is the embryo, which with the endosperm forms the seed kernel. It is surrounded by the testa or seed case. The seed is connected to the embryo by the funicle (Funiculus).

The embryo can be formed in different ways. There is a -ve correlation between the embryo and the endosperm i.e., the greater the size of the embryo, the smaller the size of the endosperm and vice versa. The embryo lies either in the endosperm or close to it (Fig. X, 1).

The endosperm is utilised by the embryo during germination. It is a storage tissue for reserve materials, through which the embryo is nourished. It contains starch, albumen, oil, fat, and cellulose and accordingly it is floury, fatty, oily, pulpy, sometimes also + slimy, hard or horny. In exceptional cases, a nutritive tissue is developed from the nucleus, this is known as the perisperm, eg. cardamon, Muskat nut, cornrade, pepper, Melde etc (Fig. X, 2).

The embryo (Fig. X, 3, 4, 5) is composed at its lower end, the hypocotyl (Radicula), in the upper part it bears plumula and the Cotyledons.



Diagram 1



Diagram 2



Diagram 3

Fig. 9

(Fig. continued on the following page)



- Diagram 1: Cone of *Pinus* species (Handbook of Natural Science)  
 Diagram 2: Berry cone of *Juniperus communis*, cross-section (Handbook of Natural Science)  
 Diagram 3: Fruit-like seed with seed mantle of *Taxus baccata* (Handbook of Natural Science).

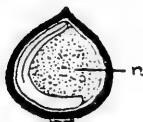


Diagram 1

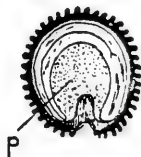


Diagram 2

Fig. 10

- Diagram 1: Fruit of *Polygonum lapathifolium* with endosperm, longitudinal-section (Handbook of Natural Science)  
 Diagram 2: Seed of *Agrostemma githago* with perisperm, longitudinal section (Handbook of Natural Science).  
 P = perisperm (Seed-case).

The first piercing part over the cotyledons is known as the epicotyl, under which one finds the axle part, the hypocotyl piercing part. In the mono-cotyledonary plants, only one Cotyledon is present.

The Cotyledons are laminated; they may swell up strongly and then replace the endosperm (Leguminosae (Fig. X, 3)).

All seeds in which the cotyledons are highly developed germinate quickly, because here the embryo has already reached a high degree of independence. Such is the situation in the seeds of numerous grasses and legumes, but also in other species, especially aquatic plants. If hard testa are not developed for the protection of the embryo and endosperm, then the seeds will be incapable of experiencing a break for rest. On the other hand, in hard testa or hard pericarp, the seed may lie in dormancy for several years.

According to the position of the hypocotyl relative to the Cotyledons, it is classified as a lateral-, dorsal-, or wrinkled rooty embryo and these differences are used for the classification of cruciferae. The variable shape of the cotyledons is also used for that purpose. (Fig. XI, 1, 2, 3, 4).



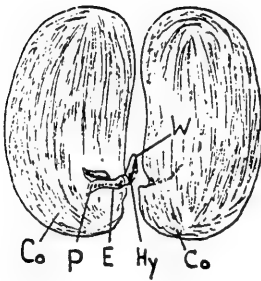


Diagram 3

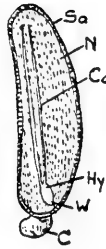


Diagram 4

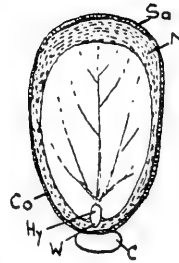


Diagram 5

Fig. 10

Diagram 3: Seed of *Phaseolus coccineus* (after Rauh). Bisected embryo; Co = Cotyledons, P = Primary leaves, E = Epicotyl Hy = Hypocotyl W = root appendix.

Diagram 4: Seed of *Ricinus communis*, medial longitudinal section (after Rauh) Sa = Seed envelope, N = Nutritive tissue Co = Cotyledons, Hy = Hypocotyl N = root appendix C = Caruncle

Diagram 5: Seed of *Ricinus communis*, transversal longitudinal section (After Rauh) Sa = Seed envelope, N = nutritive tissue, Co = Cotyledons, Hy = Hypocotyl, W = root appendix, C = Caruncle.

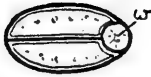


Diagram 1



Diagram 2

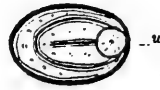


Diagram 3



Diagram 4

Fig. 11

Diagram 1: Place of radicle to the Cotyledons. Lateral root embryo of *Arabis* (Handbook of Natural Science) W = root

Diagram 2: Place of radicle to the Catyledons. Dorsal root embryo of *Alliaria* (Handbook of Natural Science) W = root

(Continued on the following page)





Diagram 3: Peace of radicle to the Cotyledons. Wrinkled rooty embryo of Sinapis (Handbook of Natural Science)

W = root

Diagram 4: Place of radicle to the Cotyledons. Curled embryo of Bunias.

The funicle or umbilical cord (Funiculus) establishes the connection between a mother individual and plumula, which are provided with nutritive material. It usually ends at the base of the ovule, the chalaza. As a dry tissue end, the umbilical cord has no significance for mature seeds. The umbilical cord is sometimes very long, eg. in Cruciferae, Magnolia, Cucurbitaceae; the seed attached to the fruit sometimes vibrates on the long funicle, backwards and forwards. Rarely, it is absent.

The testa (seed-case) (Testa) is formed from the integuments of ovule. Its external features are extremely manifold. It is differently formed, but always in such a way that it can give protection to the enclosed, delicate parts. The following remarkable points must be considered, which also play a role for differentiation (Fig. XII, 1. 2. 3).

Hilum is identified as the point where the seed separates itself from the umbilical cord or, when the latter is absent, from the placenta. It is the point of detachment of the conductible bundle, which supplies the seed with nutritive material. It is usually of different colors, lighter or darker than the testa and always lusterless. The shape of the hilum varies greatly: small, dot-like, streak-like, straight, elongated, oval, circular, arrow-shaped, etc. Mostly it is surrounded by remarkably colored spot (hilum spot, Macula-hilaris) as in the case of some legumes or the horse chestnut. In the curved seeds sometimes it runs around the seed (vicia), sometimes it is also covered by wart-like rudimentary parts of the funicle (Dolichos, Phaseolus etc). It lies either raised or depressed on the surface and it is found either at the apex or base, or within the ventral surface.

The germ aperture or seed aperture (Cicatricula) corresponds to the micropyle. It is hardly seen in most seeds and only appears in a few seeds as a dot-like depression (eg. Vicia). The root tip of the germ is always found below it. Not uncommonly, one finds at the micropyle hypertrophic growths, which lead to a protuberance which is known as the seed weal (caruncle) or aperture tubercle (eg. Euphorbiaceae, polygalaceae). The Seed suture, hilum streaks (Raphe) appears externally as a narrow, elongated weal, thinner streaks, rind, or is known through different coloration.



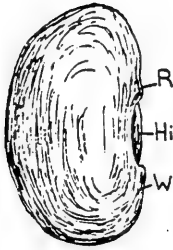


Diagram 1



Diagram 2

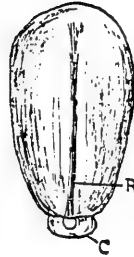


Diagram 3

Fig. 12

- Diagram 1: Seed of *Phaseolus Coccineus*. Broad side (After Rauh).  
 R = Raphe, Hi = Hilum, W = root appendix
- Diagram 2: Seed of *Phaseolus coccineus*, narrow side (after Rauh)  
 R = Raphe, Hi = Hilum W = root appendix
- Diagram 3: Seed of *Ricinus Communis*, ventral side (After Rauh)  
 R = Raphe, C = Caruncle.

The conductible bundle coming from the funicle takes its course in the suture of the seed. The vascular bundles do not pass out from the hilum directly to the seed, but pass for a short distance under the testa, and then pass to the interior branch.

The point where the raphe ends is called the chalaza; it is usually known by a small papillary eminence on the testa.

The testa is covered by a cuticle in most cases, with the exception of the hilum. Their cellular walls are commonly corked up and compact. Only when the seed is enclosed permanently in a hard pericarp does the testa remain thin and membranous (eg. Compositae, Gamineae, Umbelliferae). Pigments are stored in the cells of the inner epidermis (Pigment layer). In other seeds, the cells are provided with quick slimy and swollen inspissated layer (Brassica, Linum, Plantago etc). Highly crusty testas, which give good protection to the endosperm, have the leguminosae, Malvaceae etc.

The characteristic external surface of the seed is determined through the external cellular layers. It can be smooth, ribbed, streaked, edged, winged, furrowed, wrinkled, excavated, reticular, nodulated, dotted, prickled, net-veiny, delicate and filthy



crinite, totally pilose, squamous, lusterless, or glossy, colored or not, one-colored or variegated, pulpy or dry, thick or thin, leathery or corked, strong or hard.

Appendages are commonly found in the seed. Sometimes, they form a pulpy hook around the seed - the so-called seed mantel (Arillus), which is rich with sugars and other nutritive material (eg. *Taxus* Fig. IX, 3). Also, one finds in some seeds an appendix at different points, which is rich in oil and protein and serves for carrying off seeds by ants (the so-called Mymekochorie) (eg. *viola*).

A caruncle may originate at the micropyle (Caruncula eg. *Euphorbia*), a crista at the raphe (eg. *Asarum*, *Catha*, *Helleborus*), on funicle a thread caruncle (*Strophium* eg. *Chelidonium*). Heterokarpie means the appearance of different types of fruits on the same plant. They appear at types of fruits on the same plant. They appear at the same inflorescence or in a plant, in which the fruits of different inflorescences deviate in their form.

At the same inflorescence they occur especially by the compositae and Umbelliferae and they are influenced by their location in the inflorescence. Frequently, the lamellar blossoms are winged or provided with a pappus, while it is not the same in the marginal blossoms. In the Umbelliferae the peripheral fruits are provided sometimes with a fertile inner dehiscent fruit and a sterile or weakly developed outer diluscent fruit, while the central fruits are normal.

On the contrary, Heterocarpia are found rarely in different inflorescence.

Geocarpie is a peculiar phenomenon - the blossoms near to the soil reach the stage of seed formation after their young fruits are pushed down from above in the soil or they are pulled from down towards the soil. By the ground nut (*Arachis*) the funicles become curved in a downward direction after fertilization, become elongated and bury the young fruit in the soil, where it reaches maturity. In *Plantago cretica*, the fertilized blossom bud attains its end by laying down the inflorescence stalk in the soil; in *Cyclamae* the fruit is pulled spirally together by rolling the pedicles in the soil, where it hibernates. The pedicle grows to the outside again after maturation.

#### Means of dissemination of Fruits & Seeds

The most important factors for propagation are wind, water and animals. They apply to fruits and also to seeds.



A. Anemochoria is dissemination by wind. It is found after preparations, which lowers the speed of drop and facilitates the propagation by wind. Such fruits are provided with a feathery calyx or pappus, which act as a parachute (compositae, Valerianaceae (Fig. 1, 7,8) in disc-like appendices with the central position of the seed, or rotating parachute, coming to the fruit for help (Ulme, Birke et (Fig. 1, 3) or numerous wings are present on the fruit (Rhabarber, Polygonum etc). The one-sided winged seeds of many conifers (spruce, scots pine etc (Fig. XII, 4)) or the fruits of maple show a propeller effect. Also, the upper glume on the fruit stalk of the limetree has a similar effect. Due to the hairs which are on the fruit or on the seed (eg. cotton (Fig. XII, 5)) and also due to the distended perianth all around the fruit, the specific gravity is decreased. Also, the small size of the seed favours dissemination by the wind. A special adaptation to dissemination by wind may be found in the so-called tap runners. Here the fruits (Fig. III 5,6) or the whole plant (eg. Kochia) take a spherical shape, so that they can be easily rolled over the soil. For that reason, the individual seeds fall successively from the fruit to the outside (Medicago etc).

B. Hydrochoria. Dissemination by water is of less value than that by wind. Spongy and corky tissues may raise the swimming capacity, eg. in Beta. Because most of the seeds and fruits float on water for a long time, they can be washed away by the movement of water, thus settling far from their origin place on the bank.

C. Zoochoria. Zoochoria dissemination occurs by means of animals in different ways:

a) The fruits and seeds which are provided with look-like or prickly appendices on the surface, remain in the coat of animals or stick to the clothes of human beings and will be carried off further. Fruits settle in other parts of the world through the wool trade, commonly over the ocean. The so-called wool burdocks (Medicago spp.) defile the wool of sheep badly and reduce its quality. Tipsy of fruits pierce the skin of animals or the mucus membranes, where they cause inflammations. They fall down occasionally (Epizoochore species).



Diagram 4



Diagram 5

Fig. 12

(Fig. continued on the following page)





Diagram 1: Unilateral winged seed non Pinus sp. (Handbook of Natural Science)

Diagram 2: Long hairy (Crinite) seed of Gossypium herbaceum long section (After Engler-Prant).

b) Commonly, seeds & fruits are carried off by animals buried to serve later on as a stock. Rodents collect fruits and lose some of them during transport (Synzoochore species). Also, ants take over dissemination (Myrmekochore species). These seeds have an appendix (Elaioson) which is rich in starch & fat and serves as nutrition for ants (chelidonium, Viola, Lamium etc).

c) Berry fruits, stone fruits or seeds with pulpy seed mantles are consumed by animals, which digest only the juicy part. The hard part, "pericarp," is eliminated intact far from its production place in the excretion (Endozoochore types), eg., mistletoe, which is propagated by birds.

D. Anthropochoria. Numerous seeds and fruits are propagated by human beings consciously (cultivated plants) or unconsciously (inadity). They are spread as cultivated plants or in packed commercial goods and they are especially found in the surroundings of railway stations. Either they disappear quickly from their new location or they become naturalized.

E. Autochoria. Finally, the autochore species should also be mentioned. We understand by these that such fruits disseminate their seeds independently for a short distance. We differentiate here the dry and juicy centrifugal fruits. In the dry fruits, the stalks are bent over by grazing animals without detaching of the fruit from the plant. By flinging back, the fruit or seeds are forced to the outside (eg. Aretium, Setaria and others). The seeds fly out by the spiral- or circular - shaped volution of Carpels or clacks (Lathyrus, Lupinus etc.). Or by drying, the carpels become near to each other and press out the seeds, which are compressed to the outside (Euphorbia, vial). If such fruits are provided with awn, they are burried automatically under changeable conditions of dryness and wells (Stripa, Erodium). In the juicy centrifugal fruits the extrusion of seeds occur due to strong juice in flux at maturation. Through unequal extention, stretching of tissues occur. After maturation, a light pressure is quite enough to produce breaking of the sutures. Consequently the clacks roll in a special manner, during which the seeds become forced to the outside (eg. Impatiens).

The seeds of unexpelled berry fruits eg. of Ecballium, are sprinkled outside through a hole, which occurs by falling down. (Fig. VI, 6).

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## Identification Key

In the key, for the sake of simplicity, the fruit form is always marked with the seed. Only in case of special description of the type, the fruit has been differentiated from the seed. In the key, the most important agricultural types only are presented, with the exception of the known cereal fruits, to the point where it is not important to differentiate between them. To understand the key, we want to note the following points. Size and shape of seeds and fruits vary according to the possibilities for their formation in the plant; also, the surface color differs according to maturity and age. For this reason, it was important to represent each family according to convenience in different groups or classes.

In group I (small seeds) are those seeds which have a diameter of less than 1 mm. Their shape is accordingly hard to identify. If their size exceeds the limit, they are mentioned again in other groups.

In group II (Flat seeds) belong those seeds whose breadth is at least double their thickness. Their shape is disc-like and can be symmetric or asymmetric. Their shape may be: circular, crescent, ovoid, auriform, kidney shaped, heart shaped, pear shaped, oval, elliptical, angular. Some of the seeds are winged while others are not, and are with or without tip.

In group III (Planacouvea seeds) belong those which are concave or excavated on one side, and on the other side are arched. Their contour is spherical, elliptical, oval or crescent; the seeds may be found winged or not winged beaked or not. Their shape is + semi-circular or spherical calotte or skull cap-shaped, or in some circumstances, bowl-shaped.

To group IV (elongated seeds) belong the seeds whose length is double their breadth. Their shape is cylindrical, rod-shaped, spindle like wedge-shaped, straight or + curved to horseshoe-shaped, at one end with a beak or with a diagonally trimmed summit, on which there is a centrally-located uvular or pappus or corolla; the other end is almost also + diagonally trimmed.

Or, the seeds may be shorter and broader; their shape is thick - cylindrical, pyramid-like, blunt conical, + trimmed ovoid, short spindle-shaped. The seeds are transversally trimmed at one end and at the summit have uvula, pappus, fimbriacalyx with corolla; they may be also beaked or awned.

To group V (oval seeds with longitudinal groove) belongs to seeds which have the shape:



- a) + ovoid to almost spherical, angular to almost rhombic and their hypocotyl is interrupted through apparently clear groove.
- b) Heart-shaped, kidney-shaped, bean-shaped + spherical with + deep notch or indentation.

In group VI (oval to spherical seeds without groove or edge) are those classes of seeds, which have oval, ovoid, elliptical, spherical shape without prominent edges; eventually a tumor-like structure is found at the hilum (caruncula, Elaiosom).

In group VII (angular seeds) are the seeds which are always covered and edged. They are angular, spherical, oval, wedge-shaped axe-shaped, lense-shaped, disc-shaped, barrel-shaped, cylindrical or like an orange-slice, polyhedral, + irregularly angular to cubical. They may have spikes, tines, setas, pointed calyx, fimbriated calyx or wooly hairs or they originate from a scleranthus.

To group VII B belong the triangular and three-facet seeds.

In group VII C are seeds, which have arched dorsal surface and a domed ventral surface.

To group VIII (Glumaceous seeds) belong the seeds of Graminae, which are easily known from their awns.

The numbers after the species name are identical with those in the described part.



Key for the identification of groups

1. Seed smaller than 1 mm ..... Group I
- Seed bigger than 1 mm ..... 2
2. Disklike seed, breadth at least twice the thickness .. Group II
- Seed differently ..... 3
3. Planoconvex seed, one side - flat or + grooved, the other side convex ..... Group III
- Seed differently ..... 4
4. Seed elongated, rod-shaped, spindle-like, wedge-shaped, usually one end is blunt or pointed;
  - a) The length at least twice the breadth
  - b) Shorter and broader: thick-cylindrical, blunt pyramid-shaped, + ovoid. .... Group IV
  - Seed differently ..... 5
5. Seed + oval in shape to angular and rhomboid; hypocotyl clearly interrupted or the seed is heart-shaped, kidney-shaped, bean-shaped, + circular with + deep notch .... Group V
- Seed differently ..... 6
6. Seed ovoid, oval, rounded to elliptical without prominent borders ..... Group VI
- Seed differently ..... 7
7. Seed ovoid, oval, rounded with borders, axe-like, lenticular, disc-like, irregularly angular ..... Group VII
- or 3 borders and 3 surfaces ..... Group VII B
- or dorsal surface convex, ventral surface + clearly domed..... Group VII C
- Seed enclosed in husks ..... Group VIII S





Group I

(Small Seeds)

1	Seed tiny, not more than 0.4 mm in length.....	2
-	Seed bigger than 0.5 mm .....	14
2	Seed kidney-shaped .....	3
-	Seed not kidney-shaped .....	7
3	Surface smooth, <i>Chenopodium aristatum</i> L.223	
-	Surface rough .....	4
4	Seed irregularly angular, mostly membranous edges. Surface with straight rows of small tubercles. <i>Juncus squarrosus</i> L. 1186	
-	Surface with concentric rows of small facets or tubercles .....	5
5	Surface with tubercles, dorsal surface straight, lateral sides flat, sharp angles, <i>Viscaria vulgaris</i> Bernh. 210	
-	Surface with facets, lateral sides arched .....	6
6	Dorsal surface and lateral sides arched, <i>Gypsophila</i> <i>muralis</i> L. 179	
-	Lateral sides arched, dorsal surface straight, edges rounded, <i>Arenaria serpyllifolia</i> L.171.	
7	(2) Seed with distinct large hilum at the apex, <i>Mentha rotundifolia</i> (L.) Huds. 1225	
-	Hilum unremarkable	8
8	Seed with discontinued hypocotyl .....	9
-	Seed without discontinued hypocotyl .....	11
9	Contour almost rounded, <i>Chenopodium vulnureum</i> L. 232.	
-	Contour ovoid, to rectangular .....	10
10	<i>Draba verna</i> L. 687	
-	<i>Draba spec.</i>	
11	Surface smooth .....	12
-	Surface rough, excavated, reticulated or uneven....	13
12	In contour, thick ovoid, pointed on both ends, <i>Juncus bufonius</i> L. 1183	
-	Shape more elongated, irregular to edged, <i>Juncus</i> <i>tenuis</i> Willd. 1187.	



13	Surface excavated, <i>Orobanche minor</i> Sm. 1741	
-	Surface uneven, <i>Saxifraga granulata</i> L. 2233	
-	Surface reticulated, <i>Gratiola officinalis</i> L. 2272.	
14	(1) Surface smooth, eventually weakly undulated, or distinguishably dotted - granulated .....	15
-	Surface not smooth, but reticular, excavated, uneven, warty, with prominent veins, honey-combed, diagonally grooved, sulcate or wrinkled...	58
15	Surface glossy to highly glossy .....	16
-	Surface lustreless weakly glossy .....	30
16	Seed three-edged .....	17
-	Spinde-shaped, ovoid, oval or rounded .....	18
17	Surface highly glossy, red brown, <i>Rumex acetosella</i> L. 1922.	
-	Surface glossy, yellowish-white, <i>Scirpus silvaticus</i> L. 784	
18	Seed with rounded contour .....	19
-	Seed with spindle - to ovoid-shaped or elliptical contour .....	24
19	Surface glossy, seed spherical, <i>Lotus uliginosus</i> Schkuhr 1412.	
-	Surface glossy to highly glossy, seed lenticular..	20
20	Surface enameled highly glossy, not dotted, sharp edged, <i>Amaranthus albus</i> L. 24.	
-	Surface finely dotted .....	21
21	Lateral surfaces clearly arched, <i>Chenopodium polyspermum</i> L. 230.	
-	Lateral surfaces more flattened.....	22
22	Seed with sharp borders, surface red brown, <i>Chenopodium glaucum</i> L. 227	
-	Seed with rounded edges .....	23
23	Hypocotyl clear to the middle, <i>Chenopodium urbicum</i> L. 233	
-	Hypocotyl is clear till 1/4, <i>Chenopodium botrys</i> L. 225.	



24	(18)	Surface highly glossy .....	25
-		Spindle-shaped contour, both ends pointed, <i>Illecebrum verticillatum</i> L. 183.	
-		Ovoid or elliptical contour	
26		Elliptical contour, <i>Jasione montana</i> L. 152	
-		Ovoid contour, <i>Amaranthus deflexus</i> L. 26	
27		Seed with discontinued hypocotyl, <i>Erysimum canescens</i> Roth 690.	
-		Hypocotyl is not clearly discontinued .....	28
28		Contom is thick coma-shaped, <i>Lythrum salicaria</i> L. 1643	
-		Elliptical contour .....	29
29		<i>Campanula rotundifolia</i> L. 150	
		<i>Campanula spec.</i>	
30	(15)	Hilum-situated in the middle of the flat ventral side .....	31
31		Contour of seed nearly rounded to thick kidney- shaped, black brown.....	32
-		Contour of seed oval to ellpitical, yellowish- brown .....	33
32		<i>Chenopodium aristatum</i> L. 223	
-		<i>Chenopodium polyspermum</i> L. 230.	
33		Hilum darker, rounded, clearly interrupted, <i>Veronica serpyllifolia</i> L. 2335	
-		Hilum not darker or only slightly darker	34
34		<i>Veronica arvensis</i> L. 2326	
-		<i>Veronica peregrina</i> L. 2333	
-		<i>Veronica Verna</i> L. 2340	
35	(30)	Seed with $\pm$ clearly discontinued hypocotyl, the latter is very long or shorter than the cotyledons .....	51
-		Hypocotyl not recognizable from outside .....	36
36		Seed three-edged .....	37
-		Seed rod-like or ovoid to spherical .....	38



37	Scirpus silvaticus L. 784.	
	Scirpus radicans Schkuhr 783.	
38	+ sharp edge all around the seed, Lythrum hyssopifolia L. 1642.	
-	Edge not strolled about the seed .....	39
39	Seed rod-like or elongated, ovoid to spindle- shaped .....	40
-	Seed ovoid to spherical .....	43
40	Seed + rod-like .....	41
-	Seed elongated ovoid to spindle-shaped .....	42
41	Seed about 0.5-0.7 mm long, Gnaphalium uliginosum L. 412.	
-	Seed about 1 mm long, Gnaphalium silvaticum L. 411	
42	Seed spindle-shaped, surface with white fuzz, Tilago arvensis L. 402.	
-	Seed + irregular in shape, + elongated or ovoid, Epilobium angustifolium L. 1716.	
43	Spherical seed, Brassica elongata Ehrh. 649.	
-	Seed ovoid .....	44
44	Hilum at the end of the ventral surface, is covered by the dorsal surface .....	45
-	Hilum on the tip of the seed, can be distinguished from both sides .....	49
45	Seed almost spherical, Thymus vulgaris L. 1287	
-	Flattened seed, ovoid .....	46
46	Seed with white hilum .....	47
-	Seed without whitish hilum, Mentha pulegium L. 1224	
47	Black surface, Hedeoma pulegioides (L.) pers. 1206.	
-	Brown surface .....	48
48	Seed bigger than 0.8 mm, yellowish-brown, Majorana hortensis Moench 1219	
-	Seed smaller than 0.8 mm, brown, Origanum vulgare L. 1232	
49	(44) Hilum cone-shaped and protruded on the tip .....	50





-	Hilum not protruded laterally, <i>Comarum palustre</i> L. 2100	
50	<i>Mentha arvensis</i> L. 1223	
	<i>Mentha rotundifolia</i> (L.) HuGs 1225.	
51	(35) Seed with almost circular outline. Hypocotyl is interrupted by clear groove to the middle of the lateral side, <i>Reseda luteola</i> L. 2084	
-	Seed differently .....	52
52	Hypocotyl is shorter than the cotyledons, frequently unclearly discontinued, seed ovoid to heart-shaped, hilum sharply demarcated.....	53
-	Seed with clearly discontinued hypocotyl which is very much narrower than the cotyledons.....	54
53	Surface greenish-yellow, ovoid, <i>Trifolium parviflorum</i> Ehrh. 1504.	
54	Seed elliptical to nearly rounded, lateral sides rooty .....	55
-	Seed ovoid to oval, dorsal surface rooty .....	57
55	Seed $\pm$ spherical, hypocotyl curved, <i>Teesdalia nudicaulis</i> (L.) R. Br. 724	
-	Seed widely oval to rounded and four-cornered, hypocotyl almost straight .....	56
56	Seed $\pm$ slightly edged, yellowish brown, <i>Cardaminopsis arenosa</i> (L.) Hay. 676	
-	Seed without edges, brown, <i>Arabis auriculata</i> Lam. 642	
57	Hypocotyl equal in length or slightly longer than cotyledons, slightly separated at the tip, <i>Descurainia sophia</i> (L.) Webb 684.	
-	Hypocotyl and cotyledons lie on the tip beside each other, through which the seed is rounded, <i>Capsella bursa-pastoris</i> (L) Med. 675.	
58	(14) Surface with smooth longitudinal ribs. ....	59
-	Surface differently .....	61



59	Seed ovoid in shape, <i>Chaenorrhinum minus</i> (L.) Lange 2262. ....	60
-	Seed rod-like	
60	Ribs more prominent, through which the interstices become darker, <i>Matricaria</i> <i>chamomilla</i> L. 471.	
-	Ribs shallower, causing the interstices to be slightly dark, <i>Matricaria matricarioides</i> (Less.) Porter 474.	
61	Surface diagonally venuled or grooved .....	62
-	Surface differently .....	63
62	<i>Potentilla argentea</i> L. 2130	
-	<i>Potentilla norvegica</i> L. 2133	
-	<i>Potentilla reptans</i> L. 2135	
-	<i>Potentilla supina</i> L. 2136	
63	Seed kidney-shaped, with a clear farrow or the place of attachment .....	64
-	Seed not kidney-shaped and without farrow at the hilum.....	77
64	Surface with concentric rows of small facets ...	65
-	Surface with concentric rows of small eminences or tubercles or folds .....	68
65	Surface with $\pm$ small squared areas .....	66
-	Surface with $\pm$ small rectangular areas .....	67
66	Areas with prominent edges of silver lustre, <i>Papaver hybridum</i> L. 1793.	
-	Areas with less prominent edges <i>Papaver rhoeas</i> L. 1798	
67	Facets seen from hilum are of a height double the breadth, <i>Papaver argemone</i> L. 1789.	
-	Facets seen from hilum mostly in width more than height, <i>Papaver dubium</i> L. 1791	
68	Surface with longitudinal, flat tubercles, graphite-like, <i>Arenaria serpyllifolia</i> L. 171	
-	Surface with arranged wrinkles concentric or tubercles .....	69



69	Surface with tubercles .....	70
-	Surface with folds, <i>Stellaria graminea</i> L.	203
70	Dorsal surface grooved .....	71
-	Dorsal surface not grooved, straight or arched	72
71	Surface with tips (tipsy), fine tubercles, <i>Viscaria vulgaris</i> Bernh.	210
-	Surface with flattened tubercles, <i>Silene</i> <i>armeria</i> L.	191
72	Dorsal surface flat with protruding border, lateral surfaces depressed, <i>Silene gallica</i> L.	196
-	Dorsal surface without protruding border	73
73	Dorsal surface and lateral surfaces arched, <i>Lychnis</i> <i>flos-Cuculi</i> L.	184.
-	Dorsal surface straight or arched, lateral surfaces plain or depressed .....	74
74	Seed with protruding tubercles, <i>Stellaria media</i> (L.) Vill.	205
-	Seed with painted tubercles	75
75	Surface yellowish-brown, <i>Cerastium anomalum</i> Woldst. et. Kit	172
-	Surface reddish-brown	76
76	Small tubercles far from each other, <i>Cerastium</i> <i>caespitosum</i> Gilib.	174
-	Small tubercles near each other, <i>Cerastium</i> <i>arvense</i> L.	173
77	(63) Surface with minute depressions in longitudinal rows or/and with uneven or wavy folds .....	78
-	Surface alveolar, reticularly excavated, Crosswise venulated, reticular veins, fine warty or wrinkled.	81
78	Surface with six obliquely longitudinal rows of depressions, which are separated from each other by uneven or wavy folds	79
-	Surface with more than six rows of small depressions, which are separated from each other by uneven or wavy folds .....	80



79	Surface greyish-brown (lighter color than <i>Scrophularia nodosa</i> ) with wavy folds and clear obliquely longitudinal depressions, <i>Scrophularia peregrina</i> L. 2315	
-	Surface with more flattened folds and unclear obliquely longitudinal, numerous, narrower depressions, greyish-brown to black, <i>Scrophularia nodosa</i> L. 2314	
80	<i>Verbascum blattaria</i> L. 2318	
-	<i>Verbascum nigrum</i> L. 2319	
-	<i>Verbascum phoeniceum</i> L. 2321.	
81	(77) Surface is alveolar through elevated veins, <i>Rorippa nasturtium-aquaticum</i> (L.) Hay. 716	
-	Surface alveolar, reticularly excavated, netted, fine warty, wrinkled with concentrically arranged facets or tubercles .....	82
82	Surface with concentric arranged facets or tubercles. ....	83
-	Surface differently .....	84
83	Surface with concentrically arranged facets or tubercles <i>Papaver argemone</i> L. 1789	
-	Surface with concentrically arranged tubercles, <i>Portulaca oleracea</i> L. 1941	
84	Seed cylindrical-shaped, <i>Hypericum perforatum</i> L. 1139	
-	Seed ovoid in shape to spherical or shell-like...	85
85	Seed with setiform barb (in corn seed sometimes abraded) and on one end with a light yellow spot without seta, <i>Galium parisiense</i> L. 2177.	
-	Seed differently .....	86
86	Surface honey-combed .....	87
-	Surface not like honeycomb .....	90
87	Surface coarse honey-combed .....	89
-	Surface fine honey-combed with light yellow, smooth carina .....	88





88	<i>Digitalis purpurea</i> L. 2268	
-	<i>Digitalis lanata</i> Ehrh. 2266	
	<i>Digitalis spec.</i>	
89	Surface honey-combed with smooth carina, <i>Kickxia elatine</i> (L.) Dumort. 2275	
-	Surface honey-combed with irregularly arranged crenatures on the carinas, <i>Antirrhinum maius</i> L. 2248	
90	Surface slightly reticularly excavated to wrinkled, thick ovoid with clearly pointed hilum in the lower third of the extended side .....	91
-	Seed differently .....	92
91	<i>Nicotiano tabacum</i> L. 2359	
-	<i>Nicotiano rustica</i> L. 2358	
92	Seed + thick ovoid with big embryo on one end .....	93
-	Seed differently .....	95
93	Embryo in the middle longitudinally keeled, <i>Eragrostis pilosa</i> (L.) Pal. Beauv. subsp. <i>abyssinica</i> (Link) Kcke. 1000	
-	Embryo not keeled .....	94
94	Surface overall coarse wrinkled, <i>Eragrostis</i> <i>poacoides</i> Pal. Beauv. 1001	
-	Surface coarse only over the embryo, at other times smooth, <i>Eragrostis megastachya</i> (Koel) Link 998	
95	Surface + spherical, coarse wrinkled, <i>cuscutaepithy-</i> <i>mum</i> (L.) Murr. subsp. <i>trifalii</i> (Bab.) Hegi 578	
-	Seed shell-like .....	96
96	Surface yellowish brown, <i>Holosteum umbellatum</i> L. 181	
-	Surface reddish-gray brown, <i>Holosteum umbellatum</i> L. var. <i>glutinatum</i> (M.B.) Guerke 182.	



Group II  
(Flat Seeds)

1	Seed with bent or straight beak .....	2
-	Seed without beak or with minute beak .....	12
2	Seed appears from the broad side asymmetric .....	3
-	Seed appears from the broad side symmetrical .....	9
3	Surface smooth or nearly smooth .....	4
-	Surface with prickles or tubercles .....	6
4	Surface dark brown to black brown .....	5
-	Surface light brown to dark brown .....	7
5	Seed with brighter and broader edge, <i>Ranunculus sardous</i> G. 2068	
-	Seed with narrow and less noticeable edge, <i>Ranunculus acer</i> L. 2063	
6	Seed with barbed bent beak, moderate, smooth surface and mostly light yellow edge, <i>Ranunculus bulbosus</i> L. 2065	
-	Seed with less bent beak, finely dotted surface, mostly grey yellow edge, <i>Ranunculus repens</i> L. 2067	
7	Seed bigger than 4 mm, <i>Ranunculus arvensis</i> L. 2064	
-	Seed smaller than 4 mm	
8	Seed (without beak) up to 1.5 mm in length, <i>Ranunculus lateriflorus</i> DC. 2066	
-	Seed (without beak) bigger than 1.5 mm, <i>Ranunculus trilobus</i> Desf. 2070	
9	(2) Seed bigger than 4 mm .....	11
-	Seed smaller than 4 mm .....	10
10	Short beak, broad seed, <i>Carex Cephalophora</i> Mühl. 768	
-	Long beak, narrower seed, <i>Carex leporina</i> L. 770	
11	Surface with 6-7 nerves weak glossy, <i>Carex vulpina</i> L. 775	
-	Surface without nerves or nerves only at the base, glossy, <i>Carex muricata</i> L. 771	
12	Seed in testa which forms a rectangular, open ring at both ends .....	13
-	Seed differently .....	15



13	Seed barrel-shaped, <i>Ornithopus sativus</i> Brot. 1466	
-	Seed rectangular or an open ring on both ends....	14
14	<i>Hippocrepis comosa</i> L. 1380	
-	<i>Hippocrepis unisiliquosa</i> L. 1381	
15	Seed typically winged or $\pm$ deeply grooved on the dorsal surface .....	16
-	Seed neither winged nor grooved .....	42
16	Seed grooved on dorsal surface .....	17
-	Seed winged .....	18
17	Seed deeply grooved on dorsal surface, <i>Althaea rosea</i> Cav. 1651.	
-	Seed slightly grooved on dorsal surface, <i>Althaea officinalis</i> L. 1650	
18	Seed with longitudinal ribs or nerves.....	19
-	Seed with longitudinal ribs or nerves eventually scratched .....	26
19	Ribs on the upper surface very prominent .....	20
-	Ribs on the upper surface indistinct .....	23
20	Both sides similarly structured (with anastomising nerves, <i>A triplex hortensis</i> L. 215	
-	Sides differ in structure .....	21
21	The winged border and the ribs lighter than the seed, <i>A nethum graveolens</i> L. 2418	
-	The upper side of the seed isochromatic .....	22
22	Wing wider than the embryo, diameter of embryo less than 5 mm, contour circular to quadratic, <i>Angelica silvestris</i> L. 2420	
-	Wing narrower than the embryo, diameter of embryo more than 6 mm oval in contour, <i>Anglica archangelica</i> L. 2419	
23	Seed on the lower surface with two brown streaks..	24
-	Seed on the lower surface without brown streaks...	26
24	The two streaks club-shaped, not more than two thirds of the seed length, <i>Heracleum spondylium</i> L. 2452	



-	The two streaks narrow, not thickened, about three-fourths of the seed length or longer.....	25
25	Dorsal surface not haired, <i>Pastinaca sativa</i> L. 2464	
-	Dorsal surface haired, <i>Tordylium maximum</i> L. 2475	
26	(18) Seed with about 1 mm wide winged edge .....	27
-	Seed with narrow wing or wing only on broad end....	29
27	Seed auriculated .....	28
-	Seed oval or elliptical, <i>corispermum hyssopifolium</i> L. 234	
28	<i>Rhinanthus glabes</i> Lam 2311	
-	<i>Rhinanthus minor</i> L. 2312	
29	<i>Rhinanthus alectorolophus</i> (Scop.) Poll. 2310	
-	Seed ovoid to circular.....	30
30	Seed with notched wing on the broad end, <i>Axyris amaranthoides</i> L. 218	
-	Seed differently .....	31
31	Seed oval to $\pm$ circular with white or membranous wing .....	32
-	Seed with different colored wing, oval in contour..	34
32	Seed without wings smaller than 1.4 mm, <i>spergularia marginata</i> (D.C.) Kit 202	
-	Seed without wings over 1.5 mm .....	33
33	Seed nearly circular in contour, about 2 mm in size, <i>Matthiola incana</i> (L.) R. Br. 708	
-	Seed oval in contour, about 1.5 mm in size, <i>Alyssum desertorum</i> Stapf. 637	
34	Seed without interrupted hypocotyl .....	35
-	Seed with clear interrupted hypocotyl .....	38
35	Seed circular, black-brown with broad black brown winged edge, <i>Linaria vulgaris</i> Mill. 2283.	
-	Seed oval to elliptical with narrow wing .....	36
36	Hilum lateral to the apex, seed sharp oval in Contour .....	37
-	Seed elliptical in contour <i>corispermum nitidum</i> Kit. 235	





37	Surface dark brown, glassy, <i>Linum austriacum</i> L. 1631	
-	Surface light brown, flat, <i>Linum flavum</i> L. 1633	
38	Surface light reddish-brown .....	39
-	Surface darker .....	41
39	Seed sharp oval to rectangular <i>Lepidium virginicum</i> L. 703	
-	Seed oval to circular .....	40
40	Seed about 2 mm size, nearly circular, <i>Alyssum</i> <i>argenteum</i> Vitm. 636	
-	Seed smaller than 1.8 mm, oval, <i>Alyssum alyssoides</i> L. 635	
41	Surface dark reddish-brown, with membranous, nearly isochronic wings, <i>Arabis hirsuta</i> (L.) Scap. subsp. <i>glabra</i> (L.) Thell 643	
-	Surface more greyish-brown, with stronger isochromic wings, <i>Berteroa incana</i> (L.) DC. 648.	
42	(15) The seed is either with clearly rounded border, with ribs running all around it or the border + puffed envelope, through which the central part of the embryo is hollowed in the form of a spoon or becomes disc-shaped .....	43
-	Seed without a clearly rounded border; yet the unrounded edge may be of another color or sharply edged. ....	55
43	Seed more than 6 mm, <i>Cururbita pepo</i> 742	
-	Seed less than 6 mm .....	44
44	Seed on one side with + deeper depression, spoon- or dish-shaped grooved .....	45
-	Seed differently .....	49
45	Seed spherical, <i>omphalodes linifolia</i> Moench 103	
-	Seed + ovoid .....	46
46	Edge curled .....	47
-	Edge not curled, but curved .....	48



47	Seed more than 1.2 mm, <i>Tunica prolifera</i> (L.) Scop. 206	
-	Seed less than 1.2 mm, <i>Tunica saxifraga</i> (L.) Scop. 207	
48	Seed more than 2.0 mm, <i>Dianthus carthusianoxum</i> L. 175	
-	Seed less than 2.0 mm, <i>Dianthus deltoides</i> L. 176	
49	(44) Surface blackish .....	50
-	Surface lighter .....	52
50	Seed + rounded .....	51
-	Seed oval and tapering, <i>K<sub>0</sub>chia scoparia</i> (L.) Schr. 236	
51	Seed more than 2 mm, <i>Dianthus carthusianorum</i> L. 175	
-	Seed less than 2 mm, <i>Dianthus deltoides</i> L. 176	
52	Hilum at the tip, small	
-	Hilum at the tip of the ventral surface, whitish, horseshoe-shaped, <i>lycopus europaeus</i> L. 1218	
53	Seed smaller than 1.5 mm, light yellow, ciliate, <i>Bellis perennis</i> L. 299	
-	Seed bigger than 1.5 mm .....	54
54	Surface silver-grey-Edge narrower, <i>Achillea</i> <i>millefolium</i> L. 253	
-	Surface yellowish-grey-Edge wider, <i>Achillea</i> <i>ptarmica</i> L. 254	
55	(42) Seed kidney-shaped heart-shaped or rectangular with round corners, and lateral pointed or blunt angular groove .....	56
-	Seed oval, ovoid to pear-shaped, semicircular to rounded, commonly is the seed + cut, mostly with small unclear groove or seed nearly rectangular with two awns on the pointed end .....	83
56	Seed book-shaped, rectangular, with blunt angular groove, <i>Securigera coronilla</i> DC. 1848	
-	Seed not book-shaped .....	57



57	Seed with perigon or testa heavily haired .....	58
-	Seed differently .....	63
58	Seed bigger than 3 mm .....	59
-	Seed smaller than 3 mm .....	60
59	Seed deeply grooved on dorsal surface, <i>Althaea rosea</i> Cav. 1651	
-	Seed slightly grooved on dorsal surface, <i>Althaea officinalis</i> L. 1650	
60	Seed becomes thinner from dorsal surface to hilum	61
-	Seed does not become thinner from dorsal surface to hilum, upper surface wooly crinite, <i>Micropus erectus</i> L476	
61	Seed with setiform hairs on dorsal surface, <i>Malva maschata</i> L. 1663	
-	Seed not crinite .....	62
62	Dorsal surface rounded to keeled, <i>Malva alcea</i> L. 1659	
-	Dorsal surface with edges, <i>Malva crispa</i> L. 1660	
63	(57) Seed with clearly interrupted hypocotyl .....	64
-	Seed without clearly interrupted hypocotyl .....	65
64	Seed narrow and, surface light yellow, <i>Trigonella monspeliaca</i> L. 1515	
-	Seed widely oval, surface yellowish-brown, <i>Medicago orbicularis</i> (L.) All. 1438	
65	Seed bigger than 3 mm .....	66
-	Seed smaller than 3 mm .....	72
66	Surface smooth, clearly crinite .....	67
-	Surface rough .....	68
67	Seed sloped, thinner than 1 mm, <i>Althaea rosea</i> Cav. 1651	
-	Seed thicker than 1 mm, <i>Abutilon avicennae</i> (L.) Gaertn. 1648	
68	Surface yellowish .....	69
-	Surface dark .....	70
69	Seed bigger than 2.5 mm reddish-yellow, surface fine grooved, <i>Solanum melongena</i> L. 2370	
-	Seed smaller than 2.5 mm, light yellow, surface fine grooved, <i>Solanum melongen</i> L. 2370	



70	Hilum with tongue like crust, <i>Abutilon avicennae</i> (L.) Gaertn. 1648	
-	Hilum differently .....	71
71	<i>Datura stramonium</i> L. 2351	
-	<i>Datura tatula</i> L. 2352	
72	(65) Hilum with tongue-like crust .....	73
-	Hilum differently .....	74
73	Surface with scattered tubercles, <i>Abutilon</i> <i>avicennae</i> (L.) Gaertn. 1648.	
-	Surface with dense tubercles, <i>Abutilon indicum</i> (L.) Don 1649	
74	Surface smooth .....	75
-	Surface rough .....	80
75	Seed with interrupted hypocotyl, <i>Medicago</i> <i>orbicularis</i> (L.) All. 1438	
-	Seed without interrupted hypocotyl .....	76
76	Seed bigger than 2 mm .....	77
-	Seed smaller than 2 mm .....	79
77	Surface reddish-brown, <i>Althaea officinalis</i> L. 1650	
-	Surface gray .....	78
78	<i>Malva alcea</i> L. 1659	
-	<i>Lavatera thuringiaca</i> L. 1656	
79	<i>Malva crispa</i> L. 1660	
-	<i>Malva moschata</i> 1663	
80	(74) Surface black, <i>Saponaria officinalis</i> L. 188	
-	Surface not black .....	81
81	Surface light yellow, <i>Solanum melongena</i> L. 2370	
-	Surface darker .....	82
82	Surface reddish, shallow excavated, <i>Nicandra</i> <i>Physaloides</i> (L.) Gaertn. 2356.	
-	Surface yellowish-gray, deeper excavated, <i>Hyascyamus niger</i> L. 2353	
83	(55) Seed half a circle, breadth nearly equal to the length with or without straight peak .....	84
-	Seed narrow oval in shape, pear-shaped or rectangular with 2 awns .....	110





84	Seed with fine, straight peak .....	85
-	Seed without peak .....	91
85	Peak in the middle, surface glossy .....	86
-	Peak + diagonal .....	87
86	Both sides flat, polygonum tomentosum schrank 1917.	
-	One side flat, the other one carinate arch-like, Polygonum persicaria L. 1916	
87	Surface black .....	88
-	Surface not black .....	89
88	Seed bigger than 2 mm, Dianthus earthusianom L. 175	
-	Seed smaller than 2 mm, Dianthus deltoides L. 176	
89	Rootlet prominently diagonal and pointed, seed bigger than 3 mm, capsicum frutescens L. 2345	
-	Seed smaller than 3 mm .....	90
90	Valerianella lacusta (L.) Betcke var. olitoria L. 2491b	
-	Valerianella lacusta (L.) Betcke var. dasycarpa (Reichb.) Posp. 2491a	
91	(84) Seed smooth to slightly rough .....	92
-	Seed clearly rough, reticular, excavated, veiny, modulated .....	105
92	Hilum in the middle of the ventral surface .....	93
-	Hilum differently .....	96
93	Seed rounded, hypocotyl clearly seen, surface white as flour, Chenopodium quinoa L. 231	
-	Seed wide oval, hypocotyl indistinguishable .....	94
94	Seed bigger than 1.5 mm, Veronica teucrium L. 2338	
-	Seed smaller than 1.5 mm .....	95
95	Surface yellow, Veronica officinalis L. 2332	
-	Surface light brown, Veronica verna L. 2340	
96	Both sides flat .....	97
-	One side with a long keel, Cuphea petiolata (L.) Kochne 1641	
97	Seed smaller than 1.5 mm .....	98
-	Seed bigger than 1.5 mm .....	99



98	Hilum in the middle of the ventral side, hypocotyl not distinguished, <i>Veronica tencrium</i> L. 2338	
-	Hilum on the base, hypocotyl clearly interrupted, <i>Teesdalia nudicaulis</i> (L.) R. Br. 724	
99	Seed thaler-shaped, dorsal surface edged, <i>Atriplex hortensis</i> L. 215	
-	Seed disk shaped, edge + sharp .....	100
100	Hypocotyl interrupted, Hilum spherical, whitish, clearly interrupted <i>Medicago orbicularis</i> (L.) All. 1438	
-	Hypocotyl not interrupted, Hilum differently ....	101
101	Seed bigger than 3.5 mm, <i>Capsicum frutescens</i> L. 2345	
-	Seed smaller than 3 mm .....	102
102	Surface slightly dimpled, edges of dimples silver membranous, glossy, <i>Salanum dulcamara</i> L. 2369	
-	Surface slightly rough .....	103
103	Seed greasy glossy, <i>Rysalis peruviana</i> L. 2365	
-	Seed faint .....	104
104	Surface whitish-yellow, bigger than 2 mm, <i>Physalis alkekengi</i> L. var <i>franchetii</i> Mak. 2363	
-	Surface yellowish-brown, smaller than 2 mm, <i>Physalis lanceolata</i> Michx. 2364	
105	(91) Seed bigger than 3 mm .....	106
-	Seed smaller than 3 mm .....	108
106	Surface brownish, <i>Rhinanthus alectorolophus</i> (Scop.) Pall. 2310	
-	Surface darker .....	107
107	<i>Datura stramonium</i> L. 2351	
-	<i>Datura tatula</i> L. 2352	
108	Surface veiny reticulated, glossy, <i>Rorippa nasturtium-aquaticum</i> (L.) Hay. 716	
-	Surface reticulated excavated, alveolar .....	109
109	Surface reddish, slightly excavated, <i>Nicandra physaloides</i> (L.) Gaertn. 2356	
-	Surface yellowish-gray, deeply excavated, <i>Hyoscyamus niger</i> L. 2353	



110	Seed bigger than 5 mm .....	111
-	Seed smaller than 5 mm .....	117
111	Surface smooth .....	112
-	Surface rough, corded, prickly or ribbed .....	113
112	Surface more whitish, <i>Cucumis sativus</i> L. 737	
-	Surface more yellowish, frequently with reddish Knot, <i>Cucumis melo</i> L. 735	
113	Surface roughly granulated, <i>Bryonia alba</i> L. 730	
-	Surface differently .....	114
114	Surface corded, without prickles, <i>Onopordum acanthium</i> L. 478	
-	Surface prickly	
115	Upper side with prickles, ventral one without prickles .....	115
-	Upper and ventral side prickly, <i>Cynoglossum officinale</i> L. 91	
116	<i>Orlaya grandiflora</i> (L.) Hoffm. 2463	
-	<i>Orlaya spoc</i>	
117 (110)	Surface smooth and glossy .....	118
-	Surface rough, corded or smooth, but flat.....	129
118	Surface black, highly glossy .....	119
-	Surface brighter, yellowish-brown to dark brown	121
119	Hilum remarkably big, testa bright yellow, rarely missing, <i>Montia perfoliata</i> Howell 1940	
-	Hilum, not conspicuous .....	120
120	<i>Myosotis arvensis</i> (L.) Hill 100	
-	<i>Myosotis spec.</i>	
121	Hilum lateral on the margin or the apex .....	122
-	Hilum at the apex .....	126
122	Seed smaller than 2 mm, <i>Linum catharticum</i> L. 1632	
-	Seed bigger than 2 mm .....	123
123	Surface black-brown .....	124
-	Surface brown .....	125



124	Linum perenne L. 1634	
-	Linum austriacum L. 1631	
125	Seed smaller than 3 mm, highly glossy, Linum angustifolium Huds. 1630	
-	Seed bigger than 3.5 mm, glossy, linum usitatissimum L. 1635	
126	(121) Surface slightly scratched, seed contour nearly elliptical	127
-	Surface not scratched, seed contour cuneiform, slightly ceiling .....	128
127	Campanula trachelium L. 151	
-	Campanula spec.	
128	Surface light brown, seed smaller than 2 mm, urtica urens 2484	
-	Surface brown to black, seed bigger than 2 mm, urtica pilulifera L. 2483	
129	(117) Surface with peripherally scattered cords, Thlaspi orvense L. 725	
-	Surface differently .....	130
130	Surface obliquely corded .....	131
-	Surface not obliquely corded .....	132
131	Surface dark brown, Oxalis corniculata L. 1743	
-	Surface brown, Oxalis stricta L. 1745	
132	Seed with discontinued testa through a farrow .....	133
-	Seed with discontinued testa without a farrow.....	135
133	Seed dorsally hypocotyled, surface yellowish brown, Lepidium ruderales L. 701	
-	Seed laterally hypocotyled .....	134
134	Seed oval-shaped, Thlaspi perfoliatum L. 726	
-	Seed nearly circular, Teesdalia nudicaulis (L.) R. Br. 724	
135	Seed lens- to disc-shaped compressed, with $\pm$ sharp edges, or rectangular with two awns .....	136
-	Seed hardly compressed with rounded border .....	150





136	Hilum lateral, slightly below the tip .....	137
-	Hilum at another position .....	139
137	Surface slightly rough, hilum eye-shaped, Asperugo procumbens L. 87	
-	Surface not rough .....	138
138	Surface light brown, lustreless, Linum flavum L. 1633	
-	Surface dark brown, Linum austriacum L. 1631	
139	Hilum at the rounded end, lateral to centre, slightly protruding .....	140
-	Hilum at another position .....	141
140	Alchemilla arvensis (L.) Scop. 2094	
-	Alchemilla spec.	
141	Hilum lies at the margin, elongated .....	142
-	Hilum at another position .....	145
142	Surface fluffy, Lycopersicon esculentum Mill. 2355	
-	Surface bare .....	143
143	Seed bigger than 2.5 mm, yellow, Solanum melongena L. 2370	
-	Seed smaller than 2.5 mm, yellowish-gray.....	144
144	Surface brownish, Solanum nigrum L. 2371	
-	Surface grayish, Solanum tuberosum L. 2375	
145	Hilum lies at the end of the ventral surface, covered by a ridge, ventral side slightly domed dorsal surface $\pm$ arch like, Galeopsis ladanum L. 1203	
-	Hilum lies at the tip .....	146
146	Seed nearly rectangular, with two needles, Bidens tripartita L. 301	
-	Seed narrow and oval .....	147
147	Seed bigger than 2 mm .....	148
-	Seed smaller than 2 mm .....	149
148	Surface black-brown, glossy, urtica pilulifera L. 2483	
-	Surface light brown, nearly flat, urtica cannabina L. 2481	



149	Seed flat, about 1 mm size, <i>urtica dioica</i> L. 2482	
-	Seed mild glossy, about 1.5 mm size, <i>urtica urens</i> L. 2484	
150	(135) Surface warty and uneven or granulated .....	151
-	Surface differently .....	152
151	Surface warty and uneven, hilum eye-shaped, at the edge, <i>Asperugo procumbens</i> L. 87	
-	Surface granulated, hilum at the tip, <i>Bryonia alba</i> L. 730	
152	Surface with nerves or ribs	
-	Surface smooth, <i>Elsholtzia patrini</i> (Lepech) Garcke 1202	
153	Seed on both surfaces with longitudinal cords or longitudinal ridges .....	154
-	Seed only on the upper surface with all around continuous string, <i>Sesamum indicum</i> L. 1808	
154	Seed on the upper surface with a longitudinal ridge, <i>Valerianella locusta</i> (L.) Betcke var. <i>Olitoria</i> L. 249/b	
-	Seed on the upper surface with three longitudinal cords .....	155
155	Seed strangulated below the apex, <i>Valerianadioica</i> L. 2486	
-	Seed not strangulated, <i>Valeriana officinalis</i> L. 2488	



Group III  
(Planoconvex seeds)

1.	Seed smooth on the arched side .....	63
-	Seed not smooth on the arched side .....	2
2	Upper surface with squamas, seta, hairs, prickles or occupied with nodulated or prickly cords .....	3
-	Upper surface differently .....	21
3	Upper surface occupied with squamas .....	4
-	Upper surface differently .....	5
4	<i>Eryngium planum</i> L. 2447	
-	<i>Eryngium campestre</i> L. 2445	
5	Seed bigger than 5 mm .....	6
-	Seed smaller than 5 mm .....	13
6	Seed flat, only 1 mm thick, without prickles, <i>Orlaya grandiflora</i> (L.) Hoffm. 2463	
-	Seed thicker .....	7
7	Surface with protruded cords, <i>Capnophyllum</i> <i>dichotomum</i> Lag. 2429	
-	Surface with prickles, tubercles or seta .....	8
8	Surface with fine setas, <i>Cuminum cyminum</i> L. 2440	
-	Surface with prickles or tubercles .....	9
9	Surface with two to three rows of thorns or tubercles, sad highly curved. Hilum on the tip ..	10
-	Surface with 4 or more ribs, Hilum at the slit side .....	4
10	Seed coiled up, bigger than 10 mm <i>calendula</i> <i>officinalis</i> L. 305	
-	Seed coiled up smaller than 10 mm, <i>calendula</i> <i>arvensis</i> L. 304	
11	Slit side even or slightly grooved .....	12
-	Slit side with protruding longitudinal grooves, <i>cancalis latifolia</i> L. 2434	



12	Surface with hard prickles, <i>caucalis lappula</i> (Web.) Grande 2432	
-	Surface with tubercles and fine prickles, <i>caucalis lappula</i> (Web.) Grande var. <i>muricata</i> (Bisch) Gren. et Godr. 2433	
13	(5) Lower surface flat or slightly grooved .....	14
-	Lower surface deeply grooved .....	19
14	Hilum at one end .....	15
-	Hilum at the slit side .....	17
15	Seed with thorns and smooth pre-awns, <i>tragus racemosus</i> (L.) All. 1107.	
-	Testa one piece .....	16
16	<i>Calendula officinalis</i> L. 305	
-	<i>Calendula arvensis</i> L. 304	
17	Seed bigger than 4 mm, <i>Cuminum cyminum</i> L. 2440	
-	Seed smaller than 4 mm .....	18
18	Seed with prickly ribs, <i>Daucus carota</i> L. 2441	
-	Seed warty all over the surface, <i>Bupleurum tennissimum</i> L. 2428	
19	(13) Furrow deep and narrow, surface black-brown, <i>Anthriscus scandicina</i> (Web.) Mansf. 2422	
-	Furrow depth equals the breadth, surface gray brown .....	20
20	The surface has four rows of more than 1 mm length prickles or full of tubercles, <i>Torilis nodosa</i> (L.) Gaertn. 2478	
-	The four rows of prickles shorter than 1 mm, or surface full up with prickles, <i>Torilis japonica</i> (Houtt) DC. 2477	
21	(2) Seed beaked .....	22
-	Seed not beaked	
22	<i>Carex flava</i> L. 769	
-	<i>Carex spec.</i>	





23	Border winged .....	24
-	Border not winged .....	30
24	Upper surface with two + clear ribs .....	25
-	Upper surface with three + clear ribs .....	26
25	Surface with two clear protruding ribs, Scolymus hispanicus L. 505	
-	Surface with 2 unclear ribs, which are mostly absent, Scolymus maculatus L. 506	
26	In the center of the dorsal surface are three ribs situated close to each other .....	28
27	Seed contour circular, Aethusa cynapium L. 2416	
-	Seed contour oval, Anethum graveolens L. 2418	
28	Seed contour nearly circular, wings about 2 mm in width, Angelica selvestris L. 2420	
-	Seed oval, wings narrower .....	29
29	Seed wider than 3.5 mm, spongy, Angelica archangelica L. 2419	
-	Seed narrower than 3.0 mm, not spongy, Levisticum officinale koch 2456	
30	(23) Seed dish-shaped or shell-like .....	31
-	Seed not dish-shaped, hilum at the grooved end.	36
31	Seed shell-like hilum at the end .....	32
-	Seed dish-shaped .....	33
32	Holosteum umbellatum L. var. glutinosum (M.B.) Guerke 182.	
-	Holosteum umbellatum L. 181	
33	Hilum in the center of the inner surface of dish-shaped seed .....	35
-	Hilum in the center of the outer surface of dish-shaped seed .....	34
34	Seed diameter bigger than 3.5 mm, Omphalodes linifolia Moench 103	
-	Seed diameter smaller than 3-5 mm, Omphalodes scorpioides (Haenke) Schard. 104	



35	Seed bigger than 1.8 mm, <i>Veronica hederaefolia</i> L. 2329	
-	Seed smaller than 1.8 mm, <i>Veronica agrestis</i> L. 2324	
36	Seed contour circular, nearly spherical or hemispherical .....	37
-	Seed contour oval .....	41
37	Seed $\pm$ spherical .....	38
-	Seed $\pm$ hemispherical .....	39
38	Border of the relatively small slit side is protruded, <i>Bifora radians</i> M.B. 2425	
-	Seed spherical, <i>coriandrum sativum</i> L. 2439	
39	Surface sharp keeled, <i>Aethusa Aethusa cynapium</i> L. 2416	
-	Ribs not strongly marked .....	40
40	Seed bigger than 3 mm, <i>Coriandrum sativum</i> L. 2439	
-	Seed smaller than 3 mm, <i>cicuta virosa</i> L. 2437	
41	Surface dark brown, coarsely warty or slightly rough, bunt. ribs and interstices of the same color	42
-	Seed differently .....	44
42	Seed narrow oval, <i>Bupleurum longifolium</i> L. 2426	
-	Seed broad oval .....	43
43	Seed bigger than 3 mm, <i>Bupleurum spec.</i>	
-	Seed smaller than 3 mm, <i>Bupleurum rotundifolium</i> L. 2427	
44	Seed smaller than 2 mm.....	45
-	Seed bigger than 2 mm .....	48
45	Ribs paler than the interstices .....	46
-	Ribs of same colour as the interstices .....	47
46	Seed bigger than 1.8 mm, <i>Ammi maius</i> L. 2417	
-	Seed smaller than 1.6 mm, <i>Apium graveolens</i> L. var <i>dulce Pers</i> 2424	
47	Seed contour broad oval, slit side flat, <i>Daucus</i> <i>carota</i> L. 2441	
-	Seed contour narrow oval, slit side grooved, <i>carum ridolfia Benth et Hook.</i> 2431	



48	Seed with four brown strips on the dorsal surface, surface pale whitish, <i>Aethusa cynapium</i> L. 2416	
-	Seed differently .....	49
49	Ribs even, plump	
-	Ribs reeled or slightly winged, $\pm$ sharp .....	53
50	Seed smaller than 2.5 mm. ribs not clear, <i>Carum ridolfia</i> Benth. et Hook 2431	
-	Seed bigger than 3 mm .....	51
51	Ribs wider than intermediate spaces, seed nearly rod-shaped, <i>Folcacia vulgaris</i> Bernh. 2448	
-	Ribs of same width or narrower than the interstices .....	52
52	Slit side widely grooved, <i>Chaerophyllum temulum</i> L. 2436	
-	Slit side with narrow groove, <i>Chaerophyllum temulum</i> l. 2436	
53	Seed contour elleptical, bigger than 5 mm, <i>Foeniculum vulgare</i> Mill. 2450	
-	Seed slender, oval and tapering .....	54
54	Seed narrow crescent, longer than 3.5 mm and narrower than 1.5 mm .....	55
-	Seed wider and shorter .....	56
55	Ribs dark brown, interstices dark brown to black green, <i>Aegopodium podagraria</i> L. 2415	
-	Ribs yellowish-brown, interstices brown, <i>Carum Carvi</i> L. 2430	
56	Ribs light brown, slightly lighter in color than the interstices .....	57
-	Ribs yellowish, markedly lighter in color than the interstices .....	58
57	Seed about 3 mm long, <i>Pimpinella maior</i> (L.) Huds 2468	
-	Seed about 2 mm long, <i>Pimpinella saxifraga</i> L. 2469	



58	Seed wider than 1.5 mm .....	59
-	Seed narrower than 1.5 mm .....	61
59	Seed evenly arched, the abraded ribs with blunt prickles, <i>Daucus Carota</i> L. 2441	
-	Seed highly arched, cords smooth and corrugated	60
60	Surface white crinite, light brown, seed contour pear-shaped, ribs slightly protruding, <i>Pimpinella anisum</i> L. 2467	
-	Surface longitudinally folded, brown, seed contour wide oval, cords coarse, <i>conuim maculatum</i> L. 2438	
61	Surface brown, <i>Ammi maius</i> L. 2417	
-	Surface gray brown .....	62
62	Seed broad oval, ribs thin filamentous, pistil bolster cone-shaped, pistil then elongated, <i>Petroselinum crispum</i> (Mill.) Nym. ex Hort. Kew. 2465	
-	Seed oval and elongated ribs protruding, pistil bolster slightly arched, pistil very short, <i>Petroselinum segetum</i> (L.) Koch 2466	
63	(1) Seed surrounded by husks .....	64
-	Seed without husks .....	65
64	<i>Panicum</i> , see chapter VIII Gramineae	
-	<i>Setaria</i> , see chapter VIII Gramineae	
65	Hilum at the tip .....	66
-	Hilum at the lower surface .....	67
66	Seed wider than 1 mm, <i>Anthriscus silvestris</i> (L.) Hoffm. 2423	
-	Seed narrower than 1 mm, <i>Anthriscus cerefolium</i> (L.) Hoffm. 2421	
67	Lower surface without groove .....	68
-	Lower surface with groove .....	69
68	Seed bigger than 1.8 mm, <i>Plantago rugelii</i> -Decne 1870	
-	Seed smaller than 1.6 mm, <i>Plantago maior</i> L. 1865	





69	Hilum composed of two elongated depressions ....	70
-	Hilum plain .....	73
70	Surface dim, <i>Plantago aristata</i> Michx. 1859	
-	Surface glossy, <i>Plantago indica</i> L. 1862	
71	Surface highly glossy, smooth .....	71
-	Surface glossy, slightly rough, <i>Plantago indica</i> L. 1862	
72	Seed with narrow border, <i>Plantago psyllium</i> L. 1868	
-	Seed with broad, protruding border, <i>Plantago indica</i> L. 1862	
73	Surface pale rose-red, or red as wine .....	74
-	Surface brown	
74	Surface pale rose-red, <i>Plantago-ovata</i> Forsk, 1867	
-	Surface red as wine, <i>Plantago rhodosperma</i> Decne 1869	
75	Seed bigger than 4 mm, translucent, <i>Plantago</i> <i>amplexicaulis</i> Cav 1857.	
-	Seed smaller than 4 mm .....	76
76	Surface dim .....	77
-	Surface glossy .....	78
77	Seed smaller than 2 mm, surface light brown, <i>Plantago virginica</i> L. 1872	
-	Seed bigger than 2.5 mm, surface reddish-brown, <i>Plantago hookeriana</i> Fish. 1861	
78	Seed with dark hilum .....	79
-	Seed with whitish hilum .....	81
79	Seed smaller than 2.2 mm, surface black brown, <i>Plantago media</i> L. 1866	
-	Seed bigger than 2.5 mm, surface brown .....	80
80	Surface rough, slightly glossy, ventral surface boat-shaped mostly with narrow border, <i>Plantago</i> <i>altissima</i> L. 1856	
-	Surface smooth, highly glossy, ventral surface slightly grooved mostly with protruding border, <i>Plantago lanceolata</i> L. 1864	



81	Seed contour oval and pointed, on the dorsal surface with a <u>+</u> clear diagonal and longitudinal groove, <i>Plantago sempervirens</i> Cr. 1871	
-	Seed oval .....	82
82	Seed with narrow border .....	83
-	Seed with broad, protruding border .....	84
83	The borders run parallel thin, <i>Plantago hookerianai</i> Fish. 1861	
-	The borders not parallel thicker, <i>Plantago psyllium</i> L. 1868	
84	Surface highly glossy, dark-brown, smooth, <i>Plantago media</i> L. 1866	
-	Surface glosssy, paler, slightly rough, <i>Plantago indica</i> L. 1862	



Group IV

Elongated Seeds

1	Seed length four times as the width .....	2
-	Seed wider .....	98
2	Seed longer than 10 mm .....	3
-	Seed shorter than 10 mm .....	13
3	Seed with beak .....	4
-	Seed without beak .....	11
4	Seed ribbed on one surface, the other one smooth	5
-	Seed surfaces are similar .....	7
5	Seed widely ribbed on the dorsal surface, grooved on the ventral surface, <i>Scandix pecten-veneris</i> L.	2470
-	The dorsal surface is tuberos and dentated, smooth at the other surface .....	6
6	<i>Calendula officinalis</i> L. 305	
-	<i>Calendula arvensis</i> L. 304	
7	Seed bigger than 20 mm .....	8
-	Seed smaller than 20 mm .....	9
8	Seed bigger than 25 mm, <i>Tragopogon maior</i> Jacq.	546
-	Seed smaller than 25 mm, <i>Tragopogon Pratensis</i> L.	548
9	Ribs clearly dentated .....	10
-	Ribs smooth or slightly dentated <i>Crepis rheadifolia</i> M.B. 369	
10	<i>Hypochoeris Cretensis</i> Benth. et Hook. 438	
-	<i>Hypochoeris radicata</i> L. 441	
11	(3) Surface black, four-edged, rough, on each surface two grooves, <i>Bidens pilosa</i> L.	300
-	Surface paler, rounded to edged .....	12
12	Cords smooth, <i>scorzonera hispanica</i> L.	507
-	Cords nodulated, <i>Tragopogon pratensis</i> L.	548
13	(2) Seed with longitudinal groove on one surface....	14
-	Seed without longitudinal groove .....	16



14	Surface rough, <i>Anthriscus scandicina</i> (W.b) Mansf. 2422	
-	Surface smooth	
15	Seed wider than 1 mm, <i>Anthriscus silvestris</i> (L.) Hoffm. 2423	
-	Seed narrower than 1 mm, <i>Anthriscus cerefolium</i> (L.) Hoffm 2421.	
16	Surface without longitudinal ribs .....	17
-	Surface with longitudinal ribs .....	33
17	Seed spindle-shaped, at the top with spinal twisted beak, which is mostly bracken in corn seed	18
-	Seed differently .....	19
18	Seed with dense stiff hairs, narrower than 1 mm, <i>Erodium cicutarium</i> (L.) L' Herit. 875	
-	Seed with spreading stiff hairs, wider than 1 mm, <i>Erodium ciconium</i> Willd 874	
19	Hilum lateraly located .....	20
-	Hilum lies at the tip of the base .....	23
20	Seed + straight .....	21
-	Seed horseshoe-shaped .....	22
21	Dorsal surface straight, lateral surfaces without longitudinal carina, <i>Coronilla varia</i> L. 1342	
-	Seed + curved backward, lateral surfaces with longitudinal carina, <i>Coronilla scorpioides</i> (L.) kach 1341	
22	<i>Hippocrepis comosa</i> L. 1380	
-	<i>Hippocrepis unisiliquosa</i> L. 1381	
23	Seed with a long, curved hook .....	24
-	Seed differently .....	25
24	Seed broader than 1.5 mm, <i>Geum urbanum</i> L. 2119	
-	Seed narrower than 1.5 mm, <i>Geum rivale</i> L. 2118	
25	Seed broader than 1 mm .....	26
-	Seed narrower than 1 mm .....	27
26	Surface with gray hairs, <i>Echinops sphaerocephalus</i> L. 388	
-	Surface with yellowish hairs, <i>Echinops ritro</i> L. 387	





27	Seed with pappus or pappus residues .....	28
-	Seed without pappus .....	31
28	Seed more than 5 mm, surface black, with gray hairs. Pappus white, <i>Arnica montana</i> L. 281	
-	Seed smaller than 5 mm .....	29
29	Pappus is composed of 1 mm broad squamas, <i>Galinsoga parviflora</i> Cav. 405	
-	Pappus is composed of fine hairs .....	30
30	Seed more than 1.5 mm, <i>Erigeron acer</i> L. 389	
-	Seed less than 1.5 mm, <i>Erigeron canadensis</i> L. 392	
31	Seed more than 3 mm, gray-black, glossy, <i>Guizatia abyssinica</i> (L.) Cass. 414	
-	Seed less than 3 mm .....	32
32	<i>Artemisia dracunculus</i> L. 285	
-	<i>Artemisia absinthium</i> L. 283	
-	<i>Artemisia vulgaris</i> L. 288	
33	(16)Seed with awns or setas or with remaining, hard pappus or seed beaked .....	34
-	Seed without awns or setas, or with easily broken pappus .....	51
34	Seed with awns at the top or tiny .....	35
-	Seed with setas or with remaining pappus .....	40
35	Seed with awns at the top .....	36
-	Seed beaked .....	37
36	Seed broader than 1.5 mm, flat, <i>Bidens tripartita</i> L. 301	
-	Seed in cross-section quadrangular or quadratic, <i>Bidens pilosa</i> L. 300	
37	Seed narrower than 1 mm .....	38
-	Seed narrower than 1 mm .....	39
38	Surface with clear ribs, seed smaller than 5 mm, <i>Crepis setosa</i> Hall. F. 371	
-	Surface with unclear ribs, seed more than 5 mm, <i>Crepis rhoeadifolia</i> M.B. 369	



39	Beak with two tips, surface yellowish, with clear ribs, <i>Carex pseudo-cyperus</i> L. 773	
-	Seed tapers into long tip, surface gray-violet, with indistinct nerves, <i>Poa bulbosa</i> L. 1077	
40	(34) Seed with setas on the summit, <i>succisa pratensis</i> Moench 799	
-	Seed with pappus or pappus residues .....	41
41	Pappus is composed of tongue-shaped lamina or from diffuse hairs at the base .....	42
-	Pappus is composed of fine hairs .....	43
42	Pappus is composed of tongue-shaped lamina, which are horizontally spreading, seed about 1.5 mm in length, <i>Galinsaga parviflora</i> Cav. 405	
-	Pappus is composed of diffuse hairs at the base, which exhibit lacerated corolla, <i>Leontoclon medicaulis</i> (L.) Banks' ex Lawe em. Porter 458	
43	Seed with smooth ribs .....	44
-	Seed with nodulated ribs .....	49
44	Seed Cuboidal or cylindrical; at the base it becomes narrow and rounded off .....	45
-	Seed below is diagonally trimmed, <i>Inula belenium</i> L. 444	
45	Pappus is composed of white hairs .....	46
-	Pappus composed of yellowish hairs .....	47
46	<i>Hieracium pilosella</i> L. 434	
-	<i>Hieracium anurorum</i> L. em. Huds 432	
47	Seed more than 3.5 mm, <i>Hieracuim villosum</i> L. 437	
-	<i>Hieracium spec.</i>	
-	Seed less than 3.5 mm .....	48
48	<i>Heracuim laevigatum</i> willd. 431	
-	<i>Heracuim umbellatum</i> L. 436	
-	<i>Heracium spec.</i>	



49	(43)	Surface yellowish-brown, <i>Leontodon nudicaulis</i> (L.) Banks ex Lowe em. Porter 458	
-		Surface red-brown to black-brown .....	50
50		Seed mostly with long beak (longer than the rest of seed) with tips, with tines directed upwards, which become smaller from the middle towards the base, <i>Hypochoeris radicata</i> L. 441	
-		Seed not beaked or with only a short beak (shorter than the rest of seed) with tines, which remain the same till the base, <i>Hypochoeris glabra</i> L. 439	
51	(33)	Seed clearly crinite .....	52
-		Seed not crinite or only occupied with fine fuzz	57
52		Surface brownish black, occupied with dense, short, white hairs, <i>Annica montana</i> L. 281	
-		Surface lighter .....	53
53		Surface gray to brownish .....	54
-		Surface light yellow .....	56
54		Ribs clear, <i>Solidago virgaurea</i> L. 528	
-		Ribs less clear .....	55
55		Seed less than 2.5 mm, surface white, with wooly hairs, <i>Senecio vernalis</i> Waldst. et Kit. 513	
-		Seed more than 2.5 mm, surface with less dense hairs, hairs absent below pappus attachment, <i>Senecio vulgaris</i> L. 515	
56		Seed more than 1.5 mm, <i>Erigeron acer</i> L. 389	
-		Seed less than 1.5 mm, <i>Erigeron Canadensis</i> L. 392	
57	(51)	Ribs smooth .....	58
-		Ribs rough .....	79
58		Ribs fragile .....	59
-		Ribs clearly distinct .....	61
59		Seed more than 2 mm, <i>Guizotia abyssinica</i> (L.) Cass. 414	
-		Seed less than 2 mm	
60		<i>Artemisia vulgaris</i> L. 288	
-		<i>Artemisia spec.</i>	



61	Ribs lighter than the interstices .....	62
-	Ribs and interstices of same color .....	65
62	Ribs whitish, interstices dark, almost black, Chrysanthemum leucanthemum L. 345	
-	Contrasts weaker .....	63
63	Seed smaller than 1.5 mm, Matricaria chamomilla L. 471	
-	Seed bigger than 1.5 mm	
64	Seed on apex with white ring, in the centre an uvula, Senecio viscosus L. 514	
-	Seed on apex with yellowish ring, without uvula, interstices wider, Crepis Capillaris (L.) Walls. 368	
65	Surface dark grayish brown to black .....	66
-	Surface lighter or paler .....	69
66	Seed thickened club-shaped towards the apex, Guizotia abyssinica (L.) Cass 414	
-	Seed not thickened, club-shaped .....	67
67	Seed four-edged, Rudbeckia hirta L. 498	
-	Seed prismatic, with rest of pappus .....	68
68	Hieracium murorum L. em Huds. 432	
-	Hieracium spec.	
69	Seed wider than 1 mm .....	70
-	Seed narrower than 1 mm .....	72
70	Seed four-edged (quadrangular) .....	71
-	Seed in cross-section ovoid, Leontodon nudicaulis (L.) Banks ex, lowe em. Porter 458	
71	Dipsacus fullonum L. 791	
-	Dipsacus silvester Huds 793	
72	Seed thickened, club-shaped towards the apex, surface light yellow, Lapsana communis L. 453	
-	Seed not thickened, club-shaped .....	73
73	Seed smaller than 2 mm, Tanacetum vulgare L. 539	
-	Seed bigger than 2 mm .....	74





74	Seed with 10 ribs .....	75
-	Seed with fewer ribs .....	77
75	Seed four-edged, linear, <i>Inula helenium</i> L. 444	
-	Seed ovoid in cross-section, not linear .....	76
76	Surface blackish brown, <i>Crepis tectorum</i> L. 373	
-	Surface yellowish brown, <i>Crepis biennis</i> L. 367	
77	Seed bigger than 5 mm .....	78
-	Seed smaller than 5 mm, <i>Tussilago farfara</i> L. 550	
78	<i>Arachnospermum Canum</i> (C.A. Mey.) Dom 273	
-	<i>Arachnospermum Canum</i> (C.A. Mey.) Dom F. <i>Tenuissimum</i> (Bab.) Rpes. 274	
79	(57) Ribs with delicate or coarse tines or tubercles	80
-	Surface has diagonal ribs, or is diagonally wrinkled or fine granulated .....	89
80	Tines become bigger towards the apex .....	81
-	Tines remain equal in size .....	87
81	Seed markedly curved .....	82
-	Seed almost straight .....	83
82	<i>Calendula arvensis</i> L. 304	
-	<i>Calendula officinalis</i> L. 305	
83	Tines become much bigger towards the apex .....	84
-	Tines become only slightly bigger, <i>Leontodon nudicaulis</i> (L.) Banks ex. Lowe em Porter 458	
84	Seed at apex with a corona from 5 pointed squamas, <i>Chondrilla juncea</i> L. 336	
-	Seed at apex without corona .....	85
85	Surface reddish brown, <i>Taraxacum erythrospermum</i> Audrz 540	
-	Surface yellowish brown .....	86
86	Tines pointed, <i>Taraxacum officinale</i> Web. 542	
-	Tines blunt, <i>Taraxacum Kok-soghyz</i> Rodin 541	
87	(80) Pappus snow-white, <i>Hypochoeris glabra</i> L. 439	
-	Pappus light yellowish .....	88



88	Hypochoeris radicata L. 441	
-	Hypochoeris cretensis Benth et Hook 438	
89	(79) Ribs delicate granulated .....	90
-	Surface with ablique ribs or obliquely wrinkled ..	93
90	Surface reddish brown .....	91
-	Surface yellowish brown or brown .....	92
91	Crepis tectorum L. 373	
-	Crepis spec.	
92	Seed bigger than 5 mm, Leontodon hastilis L. var. vulgaris Koch 457	
-	Seed smaller than 5 mm, Leontodon autumnalis L. 456	
93	Surface with oblique ribs	
-	Surface obliquely wrinkled yellowish-brownish.....	97
94	Seed bigger than 4.5 mm, Leontodon nudicanlis (L.) Banks ex Lowe em. Porter 458	
-	Seed smaller than 4.5 mm	
95	Oblique ribs deep and hence, clear, almost annular, Picris sprengeriana (L.) Poir 486	
-	Oblique ribs clearly crossed by longitudinal ones	96
96	Seed with small uvula at the apex, Picris Stricta Jord. 487	
-	Seed without uvula at the apex, Picris lueracioides L. 485	
97	Seed bigger than 5 mm, Leontodon hastilis L. var vulgaris Koch 457	
-	Seed smaller than 5 mm, Leontodon autumnalis L. 456	
98	(1) Seed at the base with a V-shaped white hilum, Lallemantia iberica (M.B.) F. et M. 1209	
-	Seed with other shaped hilum .....	99
99	Seed on the surface either rough or smooth .....	100
-	Seed differently .....	102
100	Seed cylindrical, on both ends diagonally trimmed, every two opposite longitudinal strips rough or smooth, Cassia tora L. 1329	



-	Dorsal surface convex and smooth, ventral surface domed and rough .....	101
101	Ventral surface gray, dorsal surface brown, <i>Verbena officinalis</i> L. 2495	
-	Dorsal and ventral surface brown, <i>Verbena urticifolia</i> L. 2497	
102	Seed at one side with clearly big embryo.....	103
-	Embryo indistinct at the surface .....	106
103	Seed glossy, smaller than 2 mm, <i>Melica transsilvanica</i> Schur 1048	
-	Seed bigger than 2 mm.....	104
104	Surface yellow at the end with a whitish tuft of hair .....	105
-	Surface grayish yellow to grayish green, at the end with few curled hairs, <i>Secale Cereale</i> L. 1087	
105	<i>Avena nuda</i> L. 935	
-	<i>Avena Fatua</i> L. subsp <i>sativa</i> (L.) Thell. (nackt). 934	
-	<i>Avena fatua</i> L. subsp. <i>chinensis</i> (Fisch.) Malz 932	
106	Seed, like a piece of straw .....	107
-	Seed differently .....	108
107	Surface light yellow, seed longer than 5 mm and wider than 2 mm, <i>Aegilops cylindrica</i> Host 905	
-	Surface brown, seed shorter than 5 mm and narrower than 2 mm, <i>Lepturns cylindricus</i> Trin. 1038	
108	Seed with 2 serrated beak or pistil or needles or calyx fimbriae or on the apex with a permanent pappus or upright cone .....	109
-	Seed differently .....	134
109	Seed beaked or with a curved pistil .....	110
-	Seed differently .....	113
110	Seed beaked .....	111
-	Seed with a pistil .....	112
111	Surface yellow, with numerous ribs or nerves, <i>Carex pseudocyperus</i> L. 773	
-	Surface brownish, with few nerves, <i>Carex arenaria</i> L. 767	



112	Seed wider than 1.5 mm, <i>Genum urbanum</i> L. 2119	
-	Seed narrower than 1.5 mm, <i>Geum rivale</i> L. 2118	
113	Seed with a cone from 8 exitent straight lines on the apex .....	114
-	Seed differently .....	115
114	Surface bare, seed bigger than 5 mm, <i>Cephalaria syriaca</i> (L.) Schrad. 789	
-	Surface crinite, seed smaller than 5 mm, <i>Cephalaria transsilvanica</i> (L.) Schrad. 790	
115	Seed on the apex with a Calyx fimbriis of squama	116
-	Seed on the apex with a pappus of hairs or seta, or on the apex with needles .....	124
116	Pappus of squama .....	117
-	Pappus of hairs, or apex with needles .....	122
117	Seed bigger than 5 mm, <i>Xeranthemum cylindraceum</i> Sibth. et Sm 558	
-	Seed smaller than 5 mm .....	118
118	Pappus-squama diagonally spreading, <i>Galinsoga parviflora</i> Cav. 405	
-	Pappus-squama <u>±</u> situated vertical .....	119
119	Squama diverge in needles .....	120
-	Squama truncated .....	121
120	Seed dark brown, <i>Pulicaria vulgaris</i> Gaertn. 492	
-	Seed light brown, <i>Pulicaria dysenterica</i> (L.) Bernh. 491	
121	Squama on apex well-developed, surface of the seed yellowish, <i>Cichorium endivia</i> L. 349	
-	Squama less prominent, surface of the seed dark gray, <i>Cichorium intybus</i> L. 350	
122	Calyx fimbriis diverge in tip, <i>Succisa pratensis</i> Moench 799	
-	Calyx fimbriis collar-shaped, edged .....	123
123	Surface yellow, <i>Scabiosa columbaria</i> L. 796	
-	Surface yellow, <i>Scabiosa ochroleuca</i> L. 798	





124	(115)	Seed with needles on the apex .....	125
-		Seed with pappus on the apex .....	128
125		Seed with two to three backward serrated needles on the apex .....	126
-		Seed with serrated needles further foreward on the apex .....	127
126		Seed rectangular to quadratic, <i>Bidens pilosa</i> L.	300
-		Seed flat, <i>Bidens tripartita</i> L.	301
127		Seed cylindrical, with four long needles, <i>Aegilops cylindrica</i> Host	905
-		Seed ovoid, ventrally pointed, with more needles, <i>Aegilops ovata</i> L.	906
128		Seed bigger than 5 mm, surface with prominent ribs	129
-		Seed smaller than 5 mm.....	130
129		Seed with numerous ribs, <i>Cnicus benedictus</i> L.	358
-		Seed with few ribs, <i>Carthamus lanatus</i> L.	311
130		Pappus with auburn, firm seta, <i>Centaurea Cyanus</i> L.	317
-		Pappus differently .....	131
131		Seed bigger than 2 mm .....	132
-		Seed smaller than 2 mm .....	133
132		Pappus hairs whitish, <i>Aster Canus</i> Waldst. et Kit.	291
-		Pappus hairs yellowish, <i>Aster linosyris</i> (L.) Bernh.	293
133		Seed rod-shaped, <i>Pulicaria dysenterica</i> (L.) Bernh.	491
-		Seed wedge-shaped, <i>Solidago gigantea</i> Ait.	523
134	(108)	Hilum lateral to the base, thickened on dorsal surface or at the side .....	135
-		Hilum at the top of the base .....	153
135		Apex with pubescent hairs, seed three-edged, with domed ventral surface. Hilum lateral to the base, thickened at dorsal surface, <i>Phlomis tuberosa</i> L.	1234
-		Apex differently, seed not three-edged .....	136
136		Surface with clear ribs .....	137
-		Surface smooth .....	139



137	Surface with numerous ribs, <i>Cnicus benedictus</i> L. 358	
-	Surface with four ribs .....	138
138	Surface white, interstices smooth, <i>Carthamus</i> <i>tinctorius</i> L. 312	
-	Surface gray to brown, interstices rough, <i>Carthamus lanatus</i> L. 311	
139	Hilum at the side .....	140
-	Hilum lateral to the base .....	144
140	Seed straight or almost straight .....	141
-	Seed horseshoe-shaped, <i>Scorpiurus subvillosus</i> L. 1483	
141	Seed spindle-shaped .....	142
-	Seed cylindrical .....	143
142	Seed bigger than 3.5 mm. <i>Erodium ciconium</i> Willd. 874	
-	Seed smaller than 3.5 mm, <i>Eradium cicutarium</i> (L.) L' Herit. 875	
143	Dorsal surface straight, lateral sides without longitudinal carina, <i>Coronilla varia</i> L. 1342	
-	Seed + curved backward, lateral sides with longitudinal carina, <i>Coronilla scorpioides</i> (L.) Koch 1341	
144	Seed curved hooked at the base .....	145
-	Seed not hooked, curved at the base .....	147
145	Seed bigger than 3 mm, Pappus auburn or white, <i>Centaurea phrygia</i> L. 328	
-	Seed smaller than 3 mm, pappus white .....	146
146	Surface mostly silver-gray, <i>Centaurea melitensis</i> L. 323	
-	Surface mostly darker, <i>Centaurea maculosa</i> Lam. 322	
147	Seed with brown or reddish pappus .....	148
-	Pappus white or absent .....	149
148	Pappus auburn, dense as shaving-brush, <i>Centaurea</i> <i>Cyanus</i> L. 317	



-	Pappus yellowish-gray to brownish, less dense, loose, stretched out, <i>Centaurea scabiosa</i> L. 333	
149	Seed constricted to half through the grooving at the base, <i>Centaurea aspera</i> L. 315	
-	Grooving not so broad .....	150
150	Seed bigger than 2.5 mm .....	151
-	Seed smaller than 2.5 mm, <i>Centaurea solstitialis</i> L. 334	
151	Pappus absent, <i>Centaurea jacea</i> L. 320	
-	Pappus present .....	152
152	Pappus whitish, less fragile, <i>Centaurea maculosa</i> Lam. 322	
-	Pappus yellowish, fragile, hence pappus-hairs mostly shorter, <i>Centaurea nigra</i> L. 326	
153 (134)	Seed 4-edged, quadratic in cross-section .....	154
-	Seed not quadratic in cross-section .....	155
154	<i>Dipsacus fullonum</i> L. 791	
-	<i>Dipsacus silvester</i> Huds. 793	
155	Seed bigger than 5 mm .....	156
-	Seed smaller than 5 mm .....	163
156	Seed wider than 4 mm + compressed laterally, apex small, without uvula, <i>Helianthus annuus</i> L. 417	
-	Seed narrower than 4 mm .....	157
157	Surface smooth .....	158
-	Surface with ribs, grooved or edged .....	160
158	Apex with ring shaped, sharp, yellow margin, <i>Silyburn marianum</i> (L.) Gaertn. 520	
-	Apex oblique .....	159
159	Seed always clearly variegated, <i>Cynara scalyms</i> L. 378	
-	Seed less variegated to monochrome, <i>Cynara</i> <i>cardunculus</i> L. 377	
160	Surface gray unspotted, <i>Madia sativa</i> (L.) Mol. 470	
-	Surface spotted brown to black .....	161



161	Seed bigger than 7 mm, <i>Arctium nemorosum</i> Lej, et Court. 277	
-	Seed smaller than 7 mm .....	162
162	<i>Arctium lappa</i> L. 275	
-	<i>Arctium minus</i> (Hill) Bernh. 276	
-	<i>Arctium tomentosum</i> Mill. 278	
163 (155)	Seed compressed, flat or winged .....	164
-	Seed thick, more edged or oval or ovoid in Cross-section .....	178
164	Seed with beak or tipping beak .....	165
-	Seed without beak .....	170
165	Seed on each side with only a longitudinal rib, <i>Lactuca perermis</i> L. 447	
-	Seed on both sides each with 5.7 longitudinal ribs .....	166
166	Seed narrow, wing-shaped with edge, <i>Lactuca virosa</i> L. 542	
-	Seed not edged .....	167
167	Surface white, <i>Lactuca sativa</i> L. 450	
-	Surface grayish brown to black .....	168
168	Ribs fine granulated, <i>Lactuca saligna</i> L. 449	
-	Ribs smooth or slightly granulated .....	169
169	Surface brown to alive green, <i>Lactuca scariola</i> L. 451	
-	Surface brown to black, <i>Lactuca sativa</i> L. 450	
170 (164)	Surface smooth, seed + winged .....	171
-	Surface with ribs or wrinkled .....	173
171	Surface brown, seed rhombic in cross-section, <i>Anthemis austriaca</i> Jacq. 266	
-	Surface light gray to light brown, seed flat ...	172
172	Seed narrow wedge-shaped, narrow winged, surface lusterless to weak glossy, <i>Achillea millefolium</i> L. 253	
-	Seed broader and broader winged, surface glossy, <i>Achillea ptarmica</i> L. 254	





173	Surface with ribs .....	174
-	Surface without ribs .....	177
174	Surface straw yellow, <i>Lapsana communis</i> L. 453	
-	Surface yellow-brown to brown .....	175
175	Ribs smooth, <i>Sonchus asper</i> (L.) Hill. 530	
-	Ribs diagonally wrinkled .....	176
176	Ribs strong, especially the middle one, <i>Sonchus arvensis</i> L. 529	
-	All ribs not too stout, <i>Sonchus oleraceus</i> L. 531	
177	<i>Limonium gmelini</i> Ktze, (nackt) 1880	
-	<i>Limonium tataricum</i> (L.) Mill (nackt) 1885	
-	<i>Limonium spec.</i> (nackt)	
178 (163)	Seed with ribs .....	179
-	Seed smooth or slightly diagonally wrinkled ...	219
179	Ribs or interstices rough .....	180
-	Ribs or interstices smooth .....	196
180	Ribs edged, <i>Anthemis cotula</i> L. 267	
-	Ribs differently .....	181
181	Ribs full up with tines .....	182
-	Ribs differently .....	184
182	Surface red-brown, <i>Taraxacum erythrospermum</i> Andrz. 540	
-	Surface yellow-brown .....	183
183	Tines pointed, <i>Taraxacum officinale</i> Web. 542	
-	Tines blunt, <i>Taraxacum kak-saghyz</i> Rodin 541	
184	Surface diagonally ribbed .....	185
-	Surface rough wrinkled, undulating .....	191
185	Seed + constricted towards both ends .....	186
-	Seed slightly constricted towards the base ....	189
186	Seed with only 1 longitudinal rib on both sides, <i>Lactuca perennis</i> L. 447	
-	Seed with two or more longitudinal ribs .....	187
187	Diagonal ribs deeper and hence more clear, almost annular, <i>Picris sprengeriana</i> (L.) Pair. 486	
-	Diagonal ribs clearly interrupted by the longitudinal ribs .....	188



188	Seed with small uvula on the apex, <i>Picris stricta</i> Jord. 487	
-	Seed without uvula on the apex, <i>Picris hieracioides</i> L. 485	
189	Surface with clear longitudinal ribs .....	190
-	Surface with delicate longitudinal ribs, <i>Picris echioides</i> L. 484	
190	Middle rib stronger than the others, <i>Souchus arvensis</i> L. 529	
-	All ribs not too stout, <i>Souchus aberaceus</i> L. 531	
191 (184)	Seed clearly winged on one or more edges, <i>Chrysanthemum coronarium</i> L. 341	
-	Seed not winged or at most, with rudimentary wing .....	192
192	Ribs or edges paler than the interstices .....	193
-	Ribs and interstices of same color .....	195
193	Surface gray-green to olive brown, <i>Arnoseris minima</i> (L.) Schweigg et Koerte 282	
-	Surface brown (without green tinge) .....	194
194	Surface black-brown, <i>Matricaria inodora</i> L. 472	
-	Surface yellow-brown, <i>Chrysanthemum coronarium</i> L. 341	
195	Surface gray-green to olive-brown, <i>Arnoseris minima</i> (L.) Schweig et Koerte 282	
-	Surface brown-black variegated, <i>Cichorium intybus</i> L. 350	
196 (179)	Ribs paler than the interstices .....	197
	Ribs and interstices of same color .....	204
197	Ribs whitish, interstices almost black .....	198
-	Color contrast weaker .....	199
198	Ribs firm, their width almost as that of interstices, Uvula clear, <i>chrysanthemum leucanthemum</i> L. 345	
-	Ribs delicate, narrower than the interstices, uvula unclear, <i>Inula ensifolia</i> L. 442	



199	Seed shapeless, about 1 mm wide, <i>chrysanthemum segetum</i> L. 348	
-	Seed narrower .....	200
200	Seed bigger than 2 mm .....	201
-	Seed smaller than 2 mm .....	202
201	Seed with white ring on apex in the center with a uvula, <i>Senecio viscosus</i> L. 514	
-	Seed with yellowish ring at the apex, without uvula, interstices wider, <i>crepis capillaris</i> (L.) Walla. 368	
202	Surface light gray, <i>Chrysanthemum parthenium</i> (L.) Bernh. 347	
-	Surface darker	
203	<i>Matricaria chamomilla</i> L. 471	
-	<i>Matricaria matricarioides</i> (Less.) Porter 474 (Ribs slightly weaker)	
204 (196)	Surface dark brown to black .....	205
-	Surface paler .....	208
205	Seed bigger than 1.5 mm, surface black .....	206
-	Seed smaller than 1.5 mm, surface dark brown...	207
206	Seed wider than 1 mm, <i>Guizotia abyssinica</i> (L.) Cass. 414	
-	Seed narrower than 1 mm, <i>Rudbeckia hirta</i> L. 498	
207	<i>Artemisia vulgaris</i> L. 288	
-	<i>Artemisia dracuncululus</i> L. 285	
208	Surface whitish yellow .....	209
-	Surface light brown and darker .....	210
209	Seed flat compressed, ribs delicate, mostly not clear, <i>Grindelia squarrosa</i> (Pursh) Dunal 413	
-	Seed thicker, ribs clear, thick, <i>Anthemis ruthenica</i> M.B. 270	
210	Seed bigger than 3 mm and wider than 1 mm ....	211
-	Seed smaller than 3 mm .....	213
211	Seed 4-edged, straight, quadratic in cross-section	212
-	Seed curved, it tapers up and down, <i>Leontodon nudicaulis</i> (L.) Banks ex Lowe em. Porter 458	



212	<i>Dipsacus fullonum</i> L. 791	
-	<i>Dipsacus silvester</i> Huds. 793	
213	Seed with round thick ribs on the surface .....	214
-	Seed with delicate ribs or $\pm$ sharp edges on the surface.....	216
214	Seed almost rod-shaped, narrow, <i>Senecio jacobaea</i> L. 511	
-	Seed shapeless, compact $\pm$ conical .....	215
215	Edge at apex, protruding, <i>Anthemis arvensis</i> L. 265	
-	Edge not protruding, $\pm$ sharp, <i>Chrysanthemum segetum</i> L. 348	
216	Seed quadratic in cross-section, surface gray, <i>Tarracetum vulgare</i> L. 539	
-	Seed rhombic or oval in cross-section, surface yellow to brown .....	217
217	Seed rhombic in cross-section .....	218
-	Seed oval in cross-section, <i>Sonchus asper</i> (L.) Hill 530	
218	Seed between the four main ribs mostly smooth, <i>Anthemis austriaca</i> Jacq. 266	
-	Seed between the four main ribs always with delicate subsidiary ribs, <i>Anthemis tinctoria</i> L. 271	
219 (178)	Seed with relatively big embryo lateral to the base .....	220
-	Embryo indistinct externally .....	221
220	<i>Melica transilvanica</i> Schur 1048	
	<i>Melica spec.</i>	
221	Seed smaller than 2 mm .....	222
-	Seed bigger than 2 mm .....	223
222	<i>Artemisia vulgaris</i> L. 288	
-	<i>Artemisia absinthium</i> L. 283	
-	<i>Artemisia dracunculus</i> L. 285	
223	Surface blackish, <i>Guizotia abyssianica</i> (L.) Cass. 414	
-	Surface paler .....	224





224	Seed spindle-shaped compressed .....	225
-	Seed differently .....	226
225	<i>Limonium gmelini</i> Ktze (nackt) 1880	
-	<i>Limonium tataricum</i> (L.) Mill (nackt) 1885	
226	Seed sharp-edged, <i>Anthemis anstriaca</i> Jacq. 266	
-	Seed not sharp-edged .....	227
227	Seed at the apex with ring-shaped interrupted edge .....	228
-	Seed at the apex without ring shaped interrupted margin edge, <i>Grindelia squarrosa</i> (Push) Dunal 413	
228	Seed under the magnifying glass-delicate, diagonally wrinkled .....	229
-	Seed under the magnifying glass not diagonally wrinkled .....	230
229	Surface more dotted, diagonally wrinkled, becomes narrower towards the apex, is not annularly interrupted, <i>Carduus acanthoides</i> L. 306	
-	Surface more streak-shaped-diagonally wrinkled, becoming slightly narrower towards the apex, which is mostly annularly interrupted, <i>Carduus Callinus</i> Waldst. et Kit. 307	
230	Seed with blackish, streaky surface .....	231
-	Seed without blackish streaks .....	232
231	Seed at the base rounded, <i>Carduus nutans</i> L. 308	
-	Seed at the base $\pm$ pointed, <i>Cirsium vulgare</i> (Savi) Airy-Shaw 357	
232	Seed with one (up to 1 mm) long uvula at the apex, <i>Cirsium oberaceum</i> (L.) Scop. 355	
-	Uvula shorter .....	233
233	Surface brownish, <i>Cirsium arvense</i> (L.) Scop. 351	
-	Surface yellowish, <i>Cirsium palustre</i> (L.) Scop. 356	



Group V

(Ovoid Seeds with Longitudinal Groove)

1	Hypocotyl on seed externally distinct, mostly interrupted by <u>+</u> clear groove .....	2
	:include as yet, main seeds of Crucifirae and Leguminosae	
-	Hypocotyl on seed indistinct externally .....	103
2	Hilum spherical, dimple shaped, sharply demarcated	41
	:include as yet, a great part of Leguminosae	
-	Hilum not sharply demarcated, always slightly projecting through the breakage of the funiculus, oval or almost spherical, but not heart-shaped or kidney-shaped, mostly on hilum end double-painted	3
	: include as yet, the seeds of Cruciferæ	
3	Surface smooth .....	23
-	Surface not smooth .....	4
4	Surface ribbed, <i>Thlaspi arvense</i> L. 725	
-	Surface warty, nodulated or rough-wrinkled .....	5
5	Surface warty or nodulated .....	6
-	Surface venuled-reticular or rough-wrinkled .....	10
6	Seed bigger than 2 mm .....	7
-	Seed smaller than 2 mm .....	8
7	Surface lusterless, <i>Agrostemna githaga</i> L. 170	
-	Surface glossy, <i>Minuartia peploides</i> (L.) Hiern...	187
8	Surface red-brown, seed bigger than 1.2 mm, <i>Cochlaeria officinalis</i> L. 680	
-	Surface blackish or lead-colored, seed smaller than 1.2 mm .....	9
9	Surface blackish, lusterless, <i>Portulaca sativa</i> Haw. 1942	
-	Surface livid-gray, glossy, <i>Portulaca aleracea</i> L. 1941	
10 (5)	Surface venuled-reticular, <i>Conrigia orientalis</i> (L.) Dumort. 681	
-	Surface rough-wrinkled .....	11



11	Surface yellow-red to red-brown .....	12
-	Surface gray-brown to black-brown .....	20
12	Seed at hilum end with a black spot .....	13
-	Seed at hilum end without black spot .....	17
13	Seed bigger than 3 mm, <i>Isatis tinctoria</i> L. 698	
-	Seed smaller than 3 mm .....	14
14	Surface light-to dark-yellow, <i>Isatis praecox</i> Kit. 697	
-	Surface darker .....	15
15	Surface glossy to weak glossy, <i>Sisymbrium strictissimum</i> L. 723	
-	Surface lusterless .....	16
16	Surface yellowish brown, seed at hilum end hardly constricted, with a white spot extending along the breadth, <i>Hirschfeldia incana</i> (Juslen.) Lagr.-Foss. 694	
-	Surface brownish red, seed almost tapers at the end of the hilum, with a white punctiform spot, <i>Camelina microcarpa</i> Andr. 673	
17	Seed bigger than 1.5 mm .....	18
-	Seed smaller than 1.5 mm .....	19
18	Seed hypocotyled at dorsal surface, <i>Camelina alyssum</i> (Mill) Thell. 672	
-	Seed hypocotyled at the sides, <i>Cepidium sativum</i> L. 702	
19	Surface reddish-yellow, <i>Descurainia Sophia</i> (L.) Webb 684	
-	Surface brown, <i>Sisymbrium officinale</i> (L.) Scop. 722	
20	(11) Seed bigger than 1.8 mm .....	21
-	Seed smaller than 1.8 mm .....	22
21	Seed ovoid, at hilum end pointed, <i>Lepidium Campestre</i> (L.) R. Br. 699	
-	Seed ovoid, at hilum end hardly constricted, <i>Conringia orientalis</i> (L.) Dumort. 681	
22	Seed elliptical, <i>Barbarea stricta</i> Andr. 646	
-	Seed oval, <i>Barbarea vulgaris</i> R. Br. 647	



23	(3)	Surface glossy .....	24
-		Surface lusterless .....	27
24		Surface blackish, high glossy, <i>Reseda lutea</i> L. 2083	
-		Surface reddish brown .....	25
25		Seed at the hilum end with a black spot, <i>Erysimum cuspidatum</i> DC. 692	
-		Seed at hilum end without black spot .....	26
26		Seed more than 1.2 mm, <i>Sisymbrium austriacum</i> Jacq. 721	
-		Seed less than 1.2 m, <i>Descuraimia saphia</i> (L.) Webb 684	
27		Seed more than 1.6 mm .....	28
-		Seed less than 1.5 mm .....	34
28		Seed at the hilum end blackish .....	29
-		Seed at the hilum end not blackish .....	30
29		Seed more than 3 mm, surface red-brown, <i>Isatis</i> <i>Inctoria</i> L. 698	
-		Seed less than 3 mm, surface yellowish to dark yellow, <i>Isatis praecox</i> Kit. 697	
30		Hypocotyl interrupted through the whole length, much narrower than Cotyledons, <i>Camelina sativa</i> (L.) Crantz 674	
-		Seed differently .....	31
31		Seed winged, <i>Lepidium perfoliatum</i> L. 700	
-		Seed not winged .....	32
32		Side of Cotyledons almost straight, hypocotyl relatively highly convex, <i>Lepidium sativum</i> L. 702	
-		Both sides almost equally curved .....	33
33		Seed elliptical, surface gray-brown, <i>Cardaria</i> <i>draba</i> (L.) Desv. 677	
-		Seed ellipsoid, <i>Eruca vesicaria</i> (L.) Cav. em. Thell. subsp. <i>sativa</i> (Mill.) Thell 688	
34	(27)	Surface yellow-brown .....	35
-		Surface red-brown .....	37





35	Hypocotyl longer than the Cotyledons .....	36
-	Hypocotyl mostly equal in length as the Cotyledons, Erucastrum gallicum (Willd.) O.E. Schulz 689	
36	Diplotaxis muralis (L.) DC. 685	
-	Diplataxis tenuifolia (L.) DC. 686	
37	Seed ovoid, at hilum pointed, sides rooty, Thaspis perfoliatum L. 726	
-	Seed not at hilum pointed, more elongated, or irregular in shape, dorsal surface hypocotyled ..	38
38	Hypocotyl almost straight .....	39
-	Hypocotyl clearly convex .....	40
39	Hirschfeldia incana (Juslen.) Lagr-Foss. 694	
-	Erysimum Cuspidatum DV. 692	
40	Surface light red-brown, Erysimum cheiranthoides L. 691	
-	Surface dark red-brown, Malcolmia maritima R. Br. 707	
41	(2) Dorsal surface almost straight, Seed elongated or irregularly rectangular, not heart-shaped, kidney-shape or bean-shaped	
-	Dorsal surface curved or arched, seed heart-shape, beam-shaped or kidney-shaped .....	50
42	Seed elongated, long stretched, oval in cross- section, Galega officinalis L. 1363	
-	Seed almost rectangular to irregular quadrangular, almost rhombic .....	43
43	Seed more than 3.5 mm .....	44
-	Seed less than 3.2 mm .....	45
44	Hypocotyl interrupted by deep groove, surface yellowish, Trigonella foenum-graecum L. 1514	
-	Hypocotyl not clearly interrupted, surface olive- gray, Astragalus baeticus L. 1309	
45	Surface green-yellow, Astragalus falcatus Lam. 1311	
-	Color differently .....	46



46	Surface lusterless, <i>Trigonella monspeliaca</i> L. 1515	
-	Surface glossy or weak glossy .....	47
47	Seed outline clearly angular, <i>Astragalus hamosus</i> L. 1314	
-	Seed with rounded corners .....	48
48	Surface reddish-brown <i>Astragalus vesicarius</i> L. 1316	
-	Surface mostly variegated, olive-brown .....	49
49	<i>Astragalus asper</i> Wulf. 1308	
-	<i>Astragalus onobrychis</i> L. 1315	
50	(41) Surface smooth .....	60
-	Surface not smooth, rough-warty .....	51
51	Hypocotyl of same length or longer than the Cotyledons .....	52
-	Hypocotyl shorter than the Cotyledons .....	56
52	Seed more than 1.5 mm .....	54
-	Seed less than 1.5 mm .....	53
53	Surface yellowish to reddish, <i>Trifolium parviflorum</i> Ehrh. 15.4	
-	Surface dark olive-green to dark-brown, <i>Trifolium angulatum</i> Waldst. et, Kit. 1492	
54	Seed more than 3.5 mm, surface light gray-yellowish, <i>Cyam aphis psoralioides</i> DC. 1344	
-	Seed less than 3 mm .....	55
55	<i>Ononis spinosa</i> L. 1464	
-	<i>Ononis hircina</i> Jacq. 1463	
56	(51) Seed more than 2.5 mm, <i>Melilotus italicus</i> (L.) Lam. 1451	
-	Seed less than 2 mm .....	57
57	Seed at the groove pointed angular, hypocotyl always tapering, <i>Trigonella Coerulea</i> (L.) Ser. 1512	
-	Seed at the groove blunt angular .....	58
58	Shape oval in longitudinal and Cross-section, hypocotyl tightly compressed, <i>Melilotus sulcatus</i> Desf. 1454	
-	Shape more flatly compressed .....	59



59	Hypocotyl clearly interrupted, Seed ovoid in outline, <i>Melilotus gracilis</i> DC. 1449	
-	Hypocotyl less clearly interrupted, seed in outline, <i>Melilotus indicus</i> (L.) All. 1450	
60	(50) Surface blunt, lusterless .....	61
-	Surface glossy .....	75
61	Seed more than 2.5 mm .....	62
-	Seed less than 2.5 mm .....	65
62	Hypocotyl about one-fourth shorter than the Cotyledons .....	63
-	Hypocotyl almost of same length as the cotyledons or less shorter .....	64
63	Seed more than 3.5 mm and thicker than 1 mm, <i>Melilotus siculus</i> (Turra) Jacks. 1453	
-	Seed less than 3.2 mm and thinner than 1 mm, <i>Melilotus wolgicus</i> Poir. 1456	
64	Surface almost smooth, <i>Melilotus sulcatus</i> Desf. var. <i>maior</i> Cambess. 1455	
-	Surface fine rough, <i>Melilotus italicus</i> (L.) Lam. 1451	
65	Seed less than 1.5 mm .....	66
-	Seed more than 1.5 mm .....	70
66	Surface dark olive-green, <i>Trifolium angulatum</i> Waldst. et Kit. 1492	
-	Surface lighter .....	67
67	Surface in the lower part greenish, in the upper yellow, <i>Trifolium campestre</i> Schreb 1494	
-	Surface differently .....	68
68	Surface pale-green, <i>Trifolium arvense</i> L. 1493	
-	Surface yellow to light reddish .....	69
69	Hypocotyl more clearly interrupted, seed almost heart-shaped, <i>Trifolium parviflorum</i> Ehrh. 1504	
-	Hypocotyl compressed, seed almost oval, <i>Trifolium glomeratum</i> L. 1498	



70	(65)	Seed bean-shaped, apex of hypocotyl in the middle of the ventral surface slightly predated,	
		<i>Medicago minima</i> L. 1436	
-		Seed more oval .....	71
71		Seed less than 2 mm .....	72
-		Seed more than 2 mm .....	73
72		Hypocotyl two thirds the length of Cotyledons, <i>Melilotus officinalis</i> (L.) Lam. em. Thuill. 1452	
-		Hypocotyl about 3/4ers long as the Cotyledons, <i>Melilotus sulcatus</i> Desf. 1454	
73		Hypocotyl almost long as the Cotyledons, <i>Trigonella Coerulea</i> (L.) Ser. 1512	
-		Hypocotyl shorter than the Cotyledons .....	74
74		Hypocotyl extends longer, <i>Melilotus altissimus</i> Thuill. 1447	
-		Hypocotyl more close, <i>Melilotus albus</i> Med. 1446	
75	(60)	Seed + bean-shaped in outline, hypocotyl and Cotyledons take their course almost parallel	76
-		Seed nearly heart-shaped or kidney-shaped in outline, hypocotyl forms an angle with the Cotyledons .....	80
76		Hypocotyl appears sharp prominent at the side as small spike .....	77
-		Hypocotyl protrudes, not sharply, as a small spike .....	78
77		Seed highly curved, bigger than 2.5 mm, <i>Medicago maculata</i> Willd. 1435	
-		Seed more ovoid, smaller than 2.3 mm, <i>Medicago falcata</i> L. 1429	
78		Seed more than 3 mm, <i>Medicago denticulata</i> Wild. 1427	
-		Seed less than 2.8 mm .....	79
79		Hypocotyl mostly two-thirds to three-fourths as long as the Cotyledons, <i>Medicago sativa</i> L. 1442	
-		Hypocotyl mostly only 1/2 as long as the Cotyledons, <i>Medicago falcata</i> L. 1429	





80	(75)	Seed more than 2.5 mm .....	81
-		Seed less than 2.5 mm .....	85
81		Surface dark-brown to black .....	82
-		Surface lighter .....	83
82		Surface black, <i>Trifolium subterraneum</i> L. 1511	
-		Surface dark-brown, <i>Genista tinctoria</i> L. 1371	
83		Seed clearly angular at dorsal surface, surface highly glossy, <i>Hedysarum coronarium</i> L. 1379	
-		Seed round at the dorsal surface, surface glossy	84
84		Seed ovoid-kidney-shaped in outline, <i>Astragalus cicer</i> L. 1310	
-		Seed heart-shaped to kidney-shaped in outline, <i>Astragalus glycyphyllus</i> L. 1313	
85	(80)	Hypocotyl length almost just as that of the Cotyledons .....	86
-		Hypocotyl length not more than three-fourths that of the Cotyledons .....	90
86		Surface dark olive-green to black-brown .....	87
-		Surface lighter .....	89
87		Surface highly glossy .....	88
-		Surface glossy, <i>Trifolium hybridum</i> L. 1499	
88		Seed more than 1.3 mm, <i>Genista anglica</i> L. 1365	
-		Seed less than 1.2 mm, <i>Trifolium echinatum</i> M.B. subsp. <i>supinum</i> (Savi) A. et. Gr. 1496	
89		Surface yellow, <i>Trifolium repens</i> L. 1506	
-		Surface mostly yellow-brown spotted, <i>Trifolium fragiferum</i> L. 1497	
90	(85)	Surface reddish brown to brown-black .....	91
-		Surface lighter .....	94
91		Seed bigger than 1.5 mm .....	92
-		Seed smaller than 1.4 mm, surface highly glossy, <i>Lespedeza striata</i> Hook. et Arn, 1406	
92		Surface reddish brown, <i>Astragalus vesicarius</i> L. 1316	
-		Surface mostly variegated, olive-brown .....	93



93	<i>Astragalus asper</i> Wulf. 1308	
	<i>Astragalus onobrychis</i> L. 1315	
94	Seed more than 1.2 mm .....	96
-	Seed less than 1.2 mm .....	95
95	Surface pale-green, <i>Trifolium arvense</i> L. 1493	
-	Surface yellowish to brownish, <i>Trifolium campestre</i> Schreb. 1494	
96	Hilum with brown edges .....	97
-	Hilum without brown edges .....	98
97	Seed at hilum with bigger caruncula, surface lusterless to weak glossy, <i>Trifolium pannonicum</i> L. 1503	
-	Seed at hilum with smaller caruncula, surface glossy, <i>Trifolium striatum</i> L. 1510	
98	Seed kidney-shaped in outline .....	100
-	Seed oval-to heart-shaped in outline .....	101
100	Seed outline more ovoid, <i>Astragalus cicer</i> L. 1310	
-	Seed outline more elongated, <i>Astragalus vesicarius</i> L. 1316	
101	Hypocotyl interrupted by a white strip, surface yellow, glossy, <i>Trifolium ochraleucum</i> Huds. 1502	
-	Hypocotyl interrupted by groove .....	102
102	<i>Trifolium rubens</i> L. 1508	
	<i>Trifolium medium</i> L. 1501	
103	(1) Seed more than 6 mm .....	104
-	Seed smaller than 6 mm .....	107
104	Hilum big, remarkable, elongated, white, prominently wedge-shaped .....	105
-	Hilum not prominently wedge-shaped .....	106
105	<i>Dolichos lablab</i> L. 1355	
-	<i>Dolichos spec.</i>	
106	<i>Phaseolus spec.</i>	
-	<i>Vigna spec.</i>	
107	Seed with bigger exuberance at hilum .....	108
-	Seed without exuberance at hilum .....	109



108	Seed bigger than 3 mm, <i>Sarothamnus scoparius</i> (L.) Wimm. 1482	
-	Seed smaller than 3 mm, angular, <i>Ulex europaeus</i> L. 1518	
109	Seed in a highly curved crescent-shaped yellow testa, which is not split; one end is roundish, the other end becomes pointed- <i>Filipendula ulmaria</i> (L.) Maxim. 2113	
-	Seed differently .....	110
110	Surface smooth .....	111
-	Surface not smooth .....	125
111	Surface glossy to highly glossy .....	112
-	Surface lusterless .....	123
112	Surface black-brown to black .....	113
-	Surface lighter .....	119
113	Seed almost spherical, flattened, highly glossy	114
-	Seed thick oval, sometimes flattened, apparently kidney-shaped .....	117
114	Seed bigger than 1.5 mm .....	115
-	Seed smaller than 1.5 mm .....	116
115	Seed clearly kidney-shaped at both sides highly arched, <i>Chenopodium bonus-herricus</i> L. 224	
-	Seed nearly kidney-shaped, at one side arched, at the other blunt conical, <i>Chenopodium</i> <i>hybridum</i> L. 228	
116	Seed bigger than 1.0 mm, <i>Chenopodium album</i> L. 222	
-	Seed smaller than 1.0 mm, <i>Chenopodium urbicum</i> L. 233	
117	Seed more than 2 mm, <i>Trifolium subterraneum</i> L. 1511	
-	Seed less than 2 mm .....	118
118	Seed with sharp interrupted, small, oval hilum, <i>Lespedeza striata</i> Hook et Arn. 1406	
-	Seed with relatively big not sharp interrupted light hilum, <i>Reseda lutea</i> L. 2083	
119 (112)	Seed more than 2.5 mm .....	120
-	Seed less than 2.5 mm .....	121



120	Surface weak glossy, yellow, <i>Astragalus glycyphyllus</i> L. 1313	
-	Surface highly glossy, olive-green to dark brown, <i>Genista tinctoria</i> L. 1371	
121	Surface highly glossy, <i>Lespedeza striata</i> Hook et Arn. 1406	
-	Surface glossy .....	122
122	Hypocotyl almost as long as the Cotyledons, <i>Trifolium fragiferum</i> L. 1497	
-	Hypocotyl about two-thirds as long as the Cotyledons, <i>Trifolium striatum</i> L. 1510	
123	(111) Hilum in the middle of the convex side, <i>Scorpiurus</i> <i>subvillosus</i> L. 1483	
-	Hilum on the concave side .....	124
124	<i>Malva spec.</i>	
-	<i>Malope spec.</i>	
125	(110) Surface with concentric raws of small tubercles, grooves or facets .....	126
-	Surface warty-excavated, wrinkled-grooved, not arranged in concentric raws .....	143
126	Surface with concentric raws of tubercles or grooves .....	127
-	Surface with concentric raws of facets .....	141
127	Seed more than 2.5 mm, from dorsal surface towards hilum clearly constricted (tapered), <i>Agrostemma</i> <i>githago</i> L. 170	
-	Seed smaller, become lesser constricted .....	128
128	Seed with remarkable, lighter hilum .....	129
-	Seed with indistinct hilum .....	130
129	Seed more than 1.1 mm, slightly glossy or dim <i>Portulaca sativa</i> Haw. 1942	
-	Seed less than 1.1 mm, glossy, <i>Portulaca</i> <i>oleracea</i> L. 1941	
130	Seed with high pointed tubercle .....	131
-	Seed with lowered tubercles or grooves .....	132





131	Surface red, <i>Stellaria holostea</i> L. 204	
-	Surface gray-brown, <i>Gypsophila fastigroata</i> L. 177	
132	Seed with narrower, painted and twisted groove ...	133
-	Seed with weaker, blunt and twisted groove .....	136
133	Seed bigger than 1.5 mm, dorsal surface straight or medially grooved, <i>Silene cretica</i> L. 193	
-	Seed smaller than 1.3 mm .....	134
134	Seed with longitudinal tubercles, on the surface <i>Stellaria media</i> (L.) Vill 205	
-	Seed with small obliquely tubercles on the surface	135
135	Tubercles weak glossy, <i>Gypsophila paniculata</i> L. 180	
-	Tubercles highly glossy, <i>Gypsophila gmelini</i> Bunge 178	
136	Dorsal surface straight .....	137
-	Dorsal surface arched .....	138
137	Seed up to 1.1 mm in size, <i>Silene conica</i> L. 192	
-	Seed more than 1.1 mm, <i>Silene dichotoma</i> Ehrh. 195	
138	Lateral sides slightly arched .....	139
-	Lateral sides markedly arched .....	140
139	Surface gray, <i>Melandrium album</i> (Mill.) Garcke 185	
-	Surface brownish gray, <i>Silene noctiflora</i> L. 197	
140	Tubercles more pointed, <i>Silene cucubalus</i> Wibel 194	
-	Tubercles more blunt, <i>Silene nutans</i> L. 198	
141 (126)	Surface glossy, with rectangular facets .....	142
-	Surface lusterless, mostly with six corned facets, <i>Papaver somniferum</i> L. 1800	
142	Surface Coarse-reticular, with nearly quadratic facets, <i>Glaucium corniculatum</i> (L.) Curt. 1780	
-	Surface delicate-reticular, with longitudinal- right-angled facets, <i>Glaucium flavum</i> Cr. 1781	
143 (125)	Seed with edges, surface grooved or venuled .....	144
-	Seed without edges, surface warty-wrinkled, reticular-excavated, ribbed, grooved or venuled..	146
144	Seed with broad hilum, <i>Potentilla arenaria</i> Borkh. 2129.	
-	Seed with narrow hilum .....	145



145	Surface with prominent veins, <i>Potentilla recta</i> L. 2134	
-	Surface with faint veins, <i>Fragaria spec.</i>	
146	Seed with longitudinal ribs, hilum lighter than slit side, narrow, seed bigger than 2.5 mm, <i>Smyrniun perfoliatum</i> L. 2473	
-	Surface not ribbed .....	147
147	Hilum at one end, sharp-edged, light, <i>Potentilla anserina</i> L. 2128	
-	Hilum at the side	
148	Seed at the ventral surface longitudinally grooved, <i>Asperula cynanchica</i> L. 2167	
-	Seed at the ventral surface not grooved .....	149
149	Seed almost spherical, with deep notch, in cross-section compressed wedge-shaped from dorsal surface towards the hilum .....	150
-	Seed differently.....	157
150	Dorsal surface dense crinite, <i>Malva moschata</i> L. 1663	
-	Surface not crinite .....	151
151	Dorsal surface arched, <i>Malva alcea</i> L. 1659	
-	Dorsal surface straight .....	152
152	Lateral sides almost smooth, without ribs .....	153
-	Lateral sides totally or partially ribbed .....	154
153	Dorsal surface wrinkled-rough, <i>Malva neglecta</i> Wallr. 1664	
-	Dorsal surface sharp venuled, <i>Malva silvestris</i> L. 1666	
154	Seed on dorsal surface thicker than 2.5 mm, <i>Malva mauritiana</i> L. 1661	
-	Seed on dorsal surface thinner than 2 mm .....	155
155	Seed on dorsal surface with a longitudinal rib, <i>Malva crispa</i> L. 1660	
-	Seed without longitudinal rib on the dorsal surface .....	156



156	Seed on dorsal surface remarkably venuled, <i>Malva parviflora</i> L. 1665	
-	Seed on dorsal surface smooth venuled, <i>Malva verticillata</i> L. 1667	
157 (149)	Seed broad-oval, pointed, at pointed end with a pointed, twisted notch, ribs pass over sides and dorsal surface, <i>Malape trifida</i> Cav. 1657	
-	Seed differently .....	158
158	Seed more than 2 mm .....	159
-	Seed less than 2 mm .....	165
159	Seed three-edged, shaped like an orange-slice, <i>Ruta gruveolens</i> L. 2198	
-	Seed not angular .....	160
160	Surface shallow excavated by thick veins .....	161
-	Surface not exclavated .....	162
161	<i>Datura stramonium</i> L. 2351	
-	<i>Datura tatula</i> L. 2352	
162	Surface yellowish, hilum indistinct, but with big, reddish spot, <i>Cuscuta lupuliformis</i> Krockner 581	
-	Surface gray to black, hilum tongue-shaped ..	163
163	Sides arched, seed thick, <i>Hibiscus trionum</i> L. 1655	
-	Sides sloped, or sunken .....	164
164	Seed more than 2.5 mm, <i>Abutilon avicennae</i> (L.) Gaertn. 1648	
-	Seed less than 2.5 mm, <i>Abutilon indicum</i> (L.) Don 1649	
165 (158)	Surface $\pm$ deeply excavated or clearly wavy or Coarse diagonally wrinkled .....	166
-	Surface simply rough	
166	Surface diagonally wrinkled, hilum big, ring- shaped .....	167
-	Surface $\pm$ deeply excavated, hilum indistinct	168



167	Surface yellowish, with big, reddish spot at hilum, <i>Reseda inodora</i> Rchb. 2082	
-	Surface gray to black, without colouration of hilum, <i>Reseda phyteuma</i> L. 2086	
168	Surface delicately warty-rough, <i>Melilotus gracilis</i> DC. 1449	
-	Surface covered with a fine, lusterless membrane, seed also highly glossy .....	169
169	Seed more than 1.5 mm .....	170
-	Seed less than 1.5 mm .....	171
170	Seed at both strongly arched, <i>Chenopodium bonus henricus</i> L. 224	
-	Seed at one side arched, at the other side blunt conical, nearly kidney-shaped in outline, <i>Chenopodium hybridum</i> L. 228	
171	Seed more than 1.0 mm, <i>Chenopodium album</i> L. 222	
-	Seed less than 1.0 mm, <i>Chenopodium urbicum</i> L. 233	





Group VI

(Oval to spherical seeds without groove or edge)

1	Seed more than 6 mm .....	2
-	Seed less than 6 mm .....	22
2	Seed oval, sloped, hilum with carancula, Riconis communis L. 845	
-	Seed oval to spherical, hilum elongated to Circular .....	3
3	A depression beside the hilum, in which lies the hypocotyl .....	4
-	No depression beside the hilum .....	5
4	Pisum sativum L. subsp. hortense (Nilr.) A. et. Gr. 1479	
-	Pisum sativum L. subsp. orvense (L.) A. et. Gr. 1478	
5	Seed with bigger, whiter raphe, Dalichos lablab L. 1355	
-	Seed without raphe .....	6
6	Surface lusterless .....	7
-	Surface glossy .....	12
7	Hilum lacuna-shaped with protruding edge .....	8
-	Hilum without protruding edge .....	9
8	Seed sloped in Cross section, surface dark to black spotted against gray background, with light crescent streaks, Lupinus luteus L. 1418	
-	Seed oval in cross-section, surface darker or yellowish-white spotted against a gray background, Lupinus angustifoluis L. 1414	
9	Surface reddish-cocoa-colored to dark brown	10
-	Surface with different color .....	11
10	Seed spherical, surface cocoa-colored, Lathyrus ochrus (L.) DC. 1395	
-	Seed thick-oval, slightly flattened, surface dark red-brown, Lathyrus clymenum L. 1388	



11	Hilum straight, about 4-5 mm long, surface brown spotted, or of brown colour; seed oval, <i>Lathyrus tingitanus</i> L. 1402	
-	Hilum short about 2 mm long, seed spherical, <i>vicia narbonensis</i> L. 1532	
12	(6) Seed thick oval and pointed, surface highly glossy, <i>Coix lacrimajobi</i> L. 969	
-	Seed not pointed .....	13
13	Seed oval, flattened, hilum elongated, big at one end, seed weal big, lies in the middle of the narrow side, <i>Vicia faba</i> L. 1527	
-	Seed spherical or oval, hilum at one side .....	14
14	Hilum white to gray, in dark seeds lighter than the surface .....	15
-	Hilum of same colour as the surface or darker, light seeds darker than the surface, <i>Glycine saja</i> (L.) Sieb et Zucc. 1373	
15	Seed spherical or flattened spherical .....	16
-	Seed oval .....	18
16	Seed bigger than 10 mm, <i>Voandzeia subterranea</i> (L.) Thouars 1546	
-	Seed smaller than 9 mm .....	17
17	Seed spherical, <i>Phaseolus vulgaris</i> L. var. <i>sphaericus</i> (Savi) Alef. 1471 g.	
-	Seed flattened-spherical, hilum sunken, <i>Cajanus Cajan</i> Millsp. 1321	
18	The light part of the hilum elevated .....	19
-	Hilum not protruding .....	20
19	<i>Vigna sinensis</i> (L.) Endl. var. <i>sinensis</i> (Stickmann) Hegi 1545c.	
-	<i>Vigna sinensis</i> (L.) Endl var. <i>catjang</i> Burm. 1545a.	
20	Seed ovoid, bigger than 10 mm, <i>Voandzeia subterranea</i> (L.) Thouars 1546	
-	Seed flattened, oval .....	21



21	Hilum smaller, less than one-sixth of seed length, <i>Phaseolus vulgaris</i> L. 1471	
-	Hilum nearly one-fourth of seed length, <i>Phaseolus coccineus</i> L. 1468	
22	(1) A depression beside the hilum, in which lies the hypocotyl .....	23
-	No depression beside the hilum .....	24
23	<i>Pisum sativum</i> L. subsp. <i>hortense</i> (Neilr.) A. et Gr. 1479	
-	<i>Pisum sativum</i> L. subsp. <i>arvense</i> (L.) A. et Gr. 1478	
24	A fine longitudinal line or longitudinal fissure passes from the hilum almost to the opposite end; mostly on the hilum, and the Caruncule or exuberance .....	25
-	Seed without longitudinal line or longitudinal fissure .....	34
25	Surface smooth .....	26
-	Surface not smooth .....	31
26	Seed bigger than 2.0 mm .....	27
-	Seed smaller than 2.0 mm .....	28
27	Seed ovoid mostly ranging to spherical, <i>Euphorbia lucida</i> Waldst et Kit 835	
-	Seed longitudinally oval, <i>Euphorbia glareosa</i> M.B. 833	
28	Seed ovoid to nearly spherical .....	29
-	Seed longitudinally oval, <i>Euphorbia glareosa</i> M.B. 833	
29	Surface black-brown, glossy, <i>Euphorbia platyphylla</i> L. 837	
-	Surface light, lusterless .....	30
30	Surface silver-gray, <i>Euphorbia cyparissias</i> L. 830	
-	Surface yellow, <i>Euphorbia polychroma</i> Kern. 838	
31	(25) Hilum with a crested exuberance, surface delicate, wrinkled and warty .....	32
-	Hilum with a caruncle, which can surely be deciduous, surface reticularly excavated or reticular .....	33



32	Seed bigger than 2.5 mm, <i>Mercurialis perennis</i> L. 844	
-	Seed smaller than 2.5 mm, <i>Mercurialis annua</i> L. 843	
33	Surface gray-blue, excavated, <i>Euphorbia</i> <i>segetalis</i> L. 841	
-	Surface gray-green (old black-brown) with sharp cut reticulum, <i>Euphorbia helioscapia</i> L. 834	
34	(24) Seed with an exuberance at the hilum .....	35
-	Seed without exuberance at the hilum .....	40
35	Surface smooth .....	36
-	Surface fine reticulated, <i>Chelidonium maius</i> L. 1766	
36	Surface black, high glossy, <i>Claytonia perfoliata</i> Donn 1940	
-	Surface lighter .....	37
37	Surface light yellow to deep yellow .....	38
-	Surface brown .....	39
38	<i>Viola tricolor</i> L. 2506	
-	<i>Viola spec.</i>	
39	Seed ovoid to spherical, without appendix bigger than 1.2 mm, surface brown, <i>Luzula pilosa</i> (L.) Willd. 1190	
-	Seed oval, without appendix less than 1.2 mm, surface brown, <i>Luzula pilosa</i> (L.) Willd 1190	
40	(34) Surface smooth .....	41
-	Surface not smooth .....	100
41	Hilum relatively big, round, flat, usually occupies the whole base, <i>Lithospermum officinale</i> L. 98	
-	Hilum differently .....	42
42	Hilum broad-oval, with protruding edge, lies at the end, seed oval and flattened, <i>Lupinus</i> <i>polyphyllus</i> Lindl. 1421	
-	Hilum without protruding edge .....	43





43	Hilum oval, longitudinally oval or straight...	44
-	Hilum differently, mostly ovoid, small and indistinct .....	72
44	Hilum very long, about one-half the length of the seed circumference or longer .....	45
-	Hilum shorter .....	47
45	Seed diameter 4.5 mm, surface velvet-like, brown, <i>vicia dumetorum</i> L. 1525	
-	Seed diameter 3-4 mm, surface brown, black-dotted .....	46
46	Hilum with one or light membranous edges, <i>Vicia grandiflora</i> Scop. 1528	
-	Hilum without membranous edges <i>Vicia sepium</i> L. 1539	
47	Hilum relatively small, about 1 mm in length = 1/10 of the seed circumference .....	48
-	Hilum bigger .....	51
48	Surface highly glossy, <i>Lathyrus aphaca</i> L. 1386	
-	Surface lusterless .....	49
49	Hilum oval .....	50
-	Hilum straight, <i>Vicia articulata</i> Hornem. 1519	
50	Surface bright reddish brown to Cocoa-coloured, <i>Vicia ervilia</i> (L.) Willd. 1526	
-	Surface gray-brown, dark spotted, <i>Lathyrus sphaericus</i> Retz. 1401	
51	Surface glossy .....	52
-	Surface lusterless .....	58
52	Seed smaller than 3 mm .....	53
-	Seed bigger than 3 mm .....	57
53	Hilum about 1.5 mm in length = one-eighth of the seed circumference, <i>Lathyrus pratensis</i> L. 1397	
-	Hilum 1.5—2 mm in length = one-fourth to one-fifth of the seed circumference .....	54



54	Seed bigger than 2 mm in diameter, hilum slightly wedge-shaped .....	55
-	Seed smaller than 2 mm in diameter, hilum elliptical or straight .....	56
55	Surface black, <i>Vicia sativa</i> L. subsp. <i>angustifolia</i> (L.) Gaud. var. <i>nigra</i> L. 1537a	
-	Surface lighter, mostly variegated, <i>Vicia sativa</i> L. subsp. <i>angustifolia</i> (L.) Gaud. var. <i>segetalis</i> (Thuill.) ser. 1537b	
56	Surface blackish, hilum elliptical, <i>Vicia tetrasperma</i> (L.) Moench 1542	
-	Surface dark spotted on a yellow-green background, highly glossy, hilum straight, commonly with funiculus, <i>Vicia hirsuta</i> (L.) S.F Gray 1529	
57 (52)	Surface brown to dark olive green, hilum broad and straight, at the edge light interrupted, <i>Lathyrus niger</i> (L.) Bernh. 1393	
-	Hilum straight, clearly interrupted, not light at the edge, <i>Vicia sativa</i> L. subsp. <i>obovata</i> (Ser.) Gaud. 1538	
58 (51)	Hilum one-seventh to one-tenth of the seed circumference .....	59
-	Hilum one-third to one-fifth of the seed circumference .....	63
59	Hilum narrow and straight, with a light, projecting membranous edge, <i>Vicia atropurpurea</i> Desf. 1520	
-	Hilum without membranous edge .....	60
60	Seed sloped spherical to thick lenticular, <i>Vicia articulata</i> Hornem. 1519	
-	Seed spherical .....	61
61	Hilum lighter than the surface, surface finely dotted, <i>Lathyrus odoratus</i> L. 1396	
-	Hilum indistinct, surface not dotted .....	62



62	Hilum elliptical to straight, <i>Vicia villosa</i> Roth 1544	
-	Hilum wedge-shaped, <i>Vicia sativa</i> L. subsp. <i>angustifolia</i> (L.) Gaud. 1537	
63	(58) Seed bigger than 3 mm .....	64
-	Seed smaller than 3 mm .....	69
64	Hilum broad-elliptical, in the center is a fine line, surface delicately dotted, dark olive-green to gray-black, <i>Lathyrus odoratus</i> L. 1396	
-	Hilum straight .....	65
65	Surface yellowish to reddish .....	66
-	Surface dark brown to black .....	67
66	Seed spherical, caruncula (projecting), glossy, <i>Lathyrus achrus</i> (L.) DC. 1395	
-	Seed flattened, spherical, <i>Vicia sativa</i> L. subsp.-obovata (Ser.) Gaud. var. <i>leucosperma</i> (Moench) Ser. 1538	
67	Line of hilum sharply interrupted, at both sides with a deep groove, <i>Lathyrus montanus</i> (L.) Bernh. 1392	
-	Hilum not deep .....	68
68	Seed not symmetrical, hilum diagonal, Cotyledons light-yellow, <i>Vicia pannonica</i> Crantz 1535	
-	Seed symmetrical, hilum straight, Cotyledons light reddish-yellow, <i>Vicia sativa</i> L. subsp. <i>obovata</i> (ser.) Gaud. 1538	
69	(63) Surface yellow-earth-colored to reddish-yellow, <i>Lathyrus montanus</i> (L.) Bernh. 1392	
-	Surface darker	
70	Surface yellow-brown, marbled, in a darker tone, <i>Lathyrus vernus</i> (L.) Bernh. 1404	
-	Surface gray-green to olive-green, brown to black spotted, hilum lightly surrounded .....	71



71	Seed almost spherical, <i>Vicia cracca</i> L. 1522, 1523	
-	Seed commonly flattened-spherical, <i>Vicia unijuga</i> A.Br. 1543	
72	(43) Seed spherical, flattened-spherical or almost spherical, ovoid in Contour.	
-	Seed + sloped, ovoid to oval in contour .....	90
73	Seed sloped-spherical .....	74
-	Seed spherical or almost spherical .....	76
74	Hilum slightly projecting, surface brown, lusterless to weak glossy, <i>Comarum pulstre</i> L. 2100	
-	Hilum not projecting .....	75
75	Surface highly glossy, brown, <i>Lotus ornithopodioides</i> L. 1408	
-	Surface lusterless, yellowish-gray with a rose-colored, protruded edge, <i>A maranthus Caudatus</i> L. 25	
76	Hilum small, ovoid with lighter edge .....	77
	Hilum differently .....	80
77	Seed more than 1.5 mm, <i>Lotus siliquosus</i> L. 1409	
-	Seed smaller than 1.5 mm .....	78
78	Surface olive-green, seed smaller than 1.0 mm, <i>Lotus uliginosus</i> Schkuhr 1412	
-	Surface dark brown, seed bigger than 1.0 mm ...	79
79	<i>Lotus corniculatus</i> L. 1407	
-	<i>Lotus tenuifolius</i> Rchb. 1410	
80	Seed bigger than 3 mm .....	81
-	Seed smaller than 3 mm .....	82
81	Surface monochrome cocoa-colored, <i>Vicia ervilia</i> (L.) Willd. 1526	
-	Surface variegated darker, <i>Vicia articulata</i> Hornem. 1519	
82	Surface yellowish to reddish yellow .....	83
-	Surface dark-red to brown-black .....	86
83	Seed in spherical shell, which has pointed crown at both ends, <i>Crambe abyssinica</i> Hochst. ex Fries 682.	
-	Seed without shell or pointed crown .....	84





84	Seed smaller than 1.2 mm, <i>Brassica elongata</i> Ehrh. 649	
-	Seed bigger .....	85
85	Surface yellow to deep-yellow, <i>Sinapis alba</i> L. 717	
-	Surface yellow, tinged with rose (old seed lighter than <i>S. alba</i> ) <i>Brassica napus</i> L. em. Metzg. var. <i>glauca</i> (Roxb.) O.E. Schulz 654	
-	<i>Brassica juncea</i> (L.) Czern. var. <i>lutea</i> Batal. 651	
86	Seed usually bigger than 2.0 mm .....	87
-	Seed usually smaller than 2.0 mm .....	88
87	<i>Brassica napus</i> L. em. Metzg. var. <i>arvensis</i> (Lam.) Thell. 652	
-	<i>Brassica aleracea</i> L. 657	
88	Surface also smooth after 10 X magnification, deep black, <i>Sinapis arvensis</i> L. 719	
-	Surface delicately dotted by 10 X magnification, mostly dark red-brown .....	89
89	<i>Brassica rapa</i> L. em. Metzg. 667	
-	<i>Brassica napus</i> L. em. Metzg. var. <i>napobrassica</i> (L.) Peterm. 655	
90	(72) Hilum at the base .....	91
-	Hilum laterally located, nearly in the middle of the ventral surface or above the pointed end	93
91	Surface yellow to reddish-brown, <i>Genista</i> <i>sagittalis</i> L. 1370	
-	Surface darker .....	92
92	Surface brown, seed bigger than 2 mm, <i>Genista</i> <i>tinctoria</i> L. 1371	
-	Surface brown-black, seed smaller than 2 mm, <i>Genista anglica</i> L. 1365	
93	Seed with small dark spot at the tapered end, <i>Comarum palustre</i> L. 2100	
-	Seed without dark spot at the tip .....	94



94	Surface typically two-toned, one half yellow, the other green .....	95
-	Seed one-colored .....	96
95	<i>Anthyllis vulneraria</i> L. 1305	
-	<i>Anthyllis vulneraria</i> L. var. <i>polyphylla</i> (Kit.) ser. 1306	
96	Seed bigger than 1.5 mm .....	97
-	Seed smaller than 1.5 mm .....	98
97	Surface glossy to highly glossy, hypocotyl one-half to two-thirds the length of Cotyledons, <i>Trifolium incarnatum</i> L. 1500	
-	Surface weak glossy, hypocotyl three-fourths the length of Cotyledons, <i>Trifolium alexandrinum</i> L. 1491	
98	Surface lusterless, pale green, <i>Trifolium arvense</i> L. 1493	
-	Surface glossy, mostly yellow to red-brown ....	99
99	Hilum light with dark edge, <i>Trifolium dubium</i> Sibth. 1495	
-	Hilum without dark edge, <i>Trifolium resupinatum</i> L. 1507	
100 (40)	Seed with two large characteristic holes on the slightly sloped side, <i>Biforia radians</i> M.B. 2425	
-	Seed differently .....	101
101	Seed spherical with dimple-like depression ....	102
-	Seed without dimple-like depression .....	113
102	Surface occupied by prickles .....	103
-	Surface without prickles .....	104
103	<i>Golium aparine</i> L. 2175	
-	<i>Golium spurium</i> L. 2178	
104	Surface warty or nodulated .....	105
-	Surface wrinkled to wrinkled-granulated .....	108
105	Surface occupied by dense tubercles, <i>Galium</i> <i>valantia weber</i> 2180	
-	Surface occupied by dense warts .....	106



106	Surface mostly gray-brown to black-brown, Galium tricorne stakes 2179	
-	Surface mostly lighter .....	107
107	Galium aparine L. 2175	
-	Galium spurium L. 2178	
108	Seed bigger than 2.0 mm .....	109
-	Seed smaller than 2.0 mm .....	111
109	Surface brown, Asperula arvensis L. 2166	
-	Surface lighter .....	110
110	Galium aparine L. 2175	
-	Galium spurium L. 2178	
111	Dimple wall almost vertical, dimple relatively large and deep , surface greenish-gray to gray- brown, Asperula orientalis Baiss. et Moh. 2169	
-	Dimple wall flatter, roundish, dimple relatively small and flat, surface dark brown to black- brown .....	112
112	Galium mollugo L 2176	
-	Galium spec.	
113 (101)	Surface mild crinite, Polygala vulgaris L. 1902	
-	Surface not crinite .....	114
114	Surface ribbed .....	115
-	Surface not ribbed .....	116
115	Surface clearly ribbed, Coriandrum sativum L. 2439	
-	Surface not clearly ribbed, seed with two holes on the sloped side, Bifora radians M.B. 2425	
116	Seed cubical with rounded edges .....	117
-	Seed + spherical to oval .....	118
117	Seed bigger than 2.0 mm, Lathyrus hirsutus L. 1389	
-	Seed smaller than 1.5 mm, Vicia lathyroides L. 1530	
118	Hilum straight, oval or + circular .....	119
-	Hilum prominent indistinct .....	126



119	Seed with + circular, light interrupted hilum, without micropyle, <i>saliva officinalis</i> L. 1247	
-	Seed with micropyle .....	120
120	Hilum not less than 3 mm long = one-half of seed Circumference, <i>Lathyrus silvester</i> L. 1400	
-	Hilum smaller .....	121
121	Seed smaller than 3 mm, <i>Lathyrus nissolia</i> L. 1394	
-	Seed bigger than 3 mm .....	122
122	Surface delicate, warty .....	123
-	Surface wrinkled-rough or granulated .....	124
123	Seed with lighter hilum-surface, <i>Lathyrus annuus</i> L. 1385	
-	Seed with darker hilum-surface, only the central line white, <i>Lathyrus hirsutus</i> L. 1389	
124	Surface yellowish to light-grey, <i>Cyamopsis psoralioides</i> DC. 1344	
-	Surface dark gray to black brown .....	125
125	Seed spherical, <i>Lathyrus odoratus</i> L. 1396	
-	Seed + oval, sloped, <i>Lathyrus tuberosus</i> L. 1403	
126 (118)	Surface scaly-nodulated, <i>Galium valantia</i> Weber 2180	
-	Surface differently .....	127
127	Surface sharp, reticularly-excavated .....	128
-	Surface wrinkled-rough; delicately reticulated, fine excavated .....	132
128	Surface with concentric raws of small facets, <i>Argemone mexicana</i> L. 1760	
-	Surface without concentric raws .....	129
129	On the upper surface, the lacuna surrounded by wing with lower ridges, <i>Kickxia elatine</i> (L.) Domort. 2275	
-	Meshnetz on the upper surface sharply cut, can be clearly removed .....	130





130	Seed longitudinally-ovoid, surface with elongated reticular mesh, <i>Geranium bohemicum</i> L. 876	
-	Seed thick-oval, surface with almost equilateral six-corned net .....	131
131	Reticular-mesh in the longitudinal direction with more than 20 facets, <i>Geranium dissectum</i> Jusl. 878	
-	Reticular-mesh in the longitudinal direction with less than 15 facets, <i>Geranium rotundifolium</i> L. 884	
132	Surface yellowish to light brownish .....	133
-	Surface dark-reddish to black .....	137
133	Surface yellow, seed spherical .....	134
-	Surface grey-yellow, seed mostly compressed at one or more points .....	136
134	Seed less than 1.5 mm, <i>Brassica juncea</i> (L.) Czern var. <i>lutea</i> Batal. 651	
-	Seed more than 1.6 mm .....	135
135	Surface yellow to deep yellow, <i>Sinapis alba</i> L. 717	
-	Surface yellow tinged with rose (old seed lighter than <i>S. alba</i> ), <i>Brassica napus</i> L. em: Metzg. var. <i>glauca</i> (Roxb.) O.E. Schulz 654	
136	<i>Cuscuta epithymum</i> (L.) Murr. 577	
-	<i>Cuscuta spec.</i>	
137 (132)	Surface bloody-red to dark-red, glossy, <i>Minuartia poploides</i> (L.) Hiern 187	
-	Surface lusterless to weak glossy, not red ....	138
138	Seed bigger than 3 mm .....	139
-	Seed smaller than 3 mm .....	140
139	Seed signed delicate wrinkled, <i>Raphanus sativus</i> L. 712	
-	Surface almost smooth, <i>Raphanus raphanistrum</i> L. (bare) 711	
140	Surface blackish to black, nutritive tissue chalk white .....	141
-	Surface reddish-black, nutritive tissue yellow	143



141	Surface delicately dotted, hilum dot-shaped, light, <i>Vaccaria pyramidata</i> Med. 209	
-	Surface wrinkled .....	142
142	Hilum distinct by sit up straight light tips, surface delicately wrinkled, lusterless, <i>Muscari Comosum</i> Mill. 1621	
-	Hilum without light tips, surface coarsely wrinkled, weak glossy, <i>Ornithogalum Comosum</i> Torner 1622	
143	Surface reticulated .....	144
-	Surface delicately dotted .....	146
144	Seed oval, surface with longitudinal reticular mesh, <i>Germanium bohemicum</i> L. 876	
-	Seed thick-oval, surface with almost equilateral six, cornered reticulated .....	145
145	Reticular mesh in the longitudinal direction with more than 20 facets, <i>Geranium dissectum</i> Jusl. 878	
-	Reticular mesh in the longitudinal direction with less than 15 facets, <i>Geranium rotundifolium</i> L. 884	
146	Seed usually bigger than 2 mm .....	147
-	Seed usually smaller than 2 mm .....	149
147	Surface brown, commonly with dried white mucus covering on some locations, <i>Sinapis alba</i> L. subsp. <i>eu-alba</i> Briq. var. <i>geenuina</i> Briq. subvar. <i>melanosperma</i> Alef. 718	
-	Surface blue-black, without mucus-covering	148
148	<i>Brassica napus</i> L. em. Metzg. var. <i>arvensis</i> (Lam.) Thell 652.	
-	<i>Brassica oleracea</i> L. 657	
149	Surface smooth even under 10Xmagnification, deep black, <i>sinapis arvensis</i> L. 719	
-	Surface clearly fine dotted under 10Xmagnification, mostly dark red-brown .....	150



150 Brassica rapa L. em. Metzg. 667,668

- Brassica napus L. em, Metzg. var. napobrassica  
(L.) Peterm. 655

- Brassica juncea (L.) Czern. 650

- Brassica nigra (L.) Koch. 656

- Sinapis alba L. subsp eu-alba Briq var. genuina  
Briq. sulvar. melanosperma Alef. 718



Group VII  
(Angular Seeds)

1	Seed winged or with winged diagonal ribs or clear tines, thorns, prickles, spikes, wooly hair, cup-shaped tips or cup fimbriae; or it consists of scleranthus .....	5
-	Seed differently, smooth, ribbed or rough .....	2
2	Seed straight or sloped tipping, hilum remarkably large, occupying the hole base, smooth or excavated & bordered by protruding ring; mostly with a central uvula .....	55
-	Hilum differently, mostly smaller .....	3
3	Seed three edged, three surfaces and with two tips, hilum at the base, small .....	VII B
-	Seed differently .....	4
4	Seed with $\pm$ arched (dorsal surface) and $\pm$ sharp dome edge on the ventral surface, hilum on the ventral surface, totally or partially thickened, when the seed lies on the ventral surface .....	VII C
-	Seed differently .....	69
5	Seed existent from a scleranthus .....	6
-	Seed differently .....	7
6	<i>Beta vulgaris</i> L. subsp. <i>vulgaris</i> (L.) Thell. 221	
-	<i>Beta vulgaris</i> L. subsp. <i>maritima</i> (L.) Thell 219	
-	<i>Beta trigyna</i> Waldst. et. Kit. 220	
7	Seed winged or with winged diagonal ribs .....	8
-	Seed covered with tines, spikes prickles or wooly hairs or with cup-shaped tips or a cup-shaped fimbriae .....	23
8	Seed with numerous winged diagonal ribs .....	9
-	Seed with 4 or less longitudinal wings .....	10
9	Seed with arranged undulating rows of squamas, <i>Delphinium consolida</i> L. 2044	
-	Seed with curved undulating carina, <i>Delphinium ajacis</i> L. 2039	





10	Seed with four wings .....	11
-	Seed with less than four wings .....	14
11	Seed oval, wings transverse and opposite each other .....	12
-	Seed almost four-edged, wings almost parallel ...	13
12	Area between wings wrinkled, <i>Sarguisorba minor</i> Scop. 2160	
-	Area between wings smooth, <i>Sanguisorba</i> <i>officinalis</i> L. 2161	
13	Edges with only narrow wings, wings on borders, <i>Cakile maritima</i> Scop. 671	
-	Wings with tines, <i>Bunias crucaga</i> L. 669	
14	Seed in shell, which longer than 10 mm, <i>Isatis</i> <i>tinctoria</i> L. 698	
-	Seed not in shell, smaller than 10 mm .....	15
15	Seed spherical to lenticular with all over ring-shaped wing .....	16
-	Seed with a wing not all over the surface .....	22
16	Wing at least one-half the width of central area .....	17
-	Wing narrower .....	18
17	Wing almost of some width as central area, <i>Spergula pentandra</i> L. 200	
-	Wing one-half the width of central area, <i>Spergula</i> <i>vernalis</i> Willd. 201	
18	Surface dark gray to blackish .....	19
-	Surface lighter .....	21
19	Surface without papillae, <i>Spergula arvensis</i> L. var. <i>sativa</i> Boenn. 199b.	
-	Surface with papillae or warts .....	20
20	Surface with papillae, seed up to 1 mm size, <i>spergula arvensis</i> L. var. <i>vulgaris</i> Boenn. 199c.	
-	Surface with warts, seed up to 1.8 mm size, <i>Spergula arvensis</i> L. var. <i>maxima</i> Weihe 199a.	



21	Surface cocoa-colored, hilum stripe-shaped, <i>Lysimachia vulgaris</i> L. 1960	
-	Hilum straight-elongated, <i>Lysimachia thyrsoiflora</i> L. 1959	
22	(15) Seed fixed in yellowish to brownish capsule, more than 3 mm, <i>Onobrychis viciaefolia</i> Scop. 1461	
-	Seed black, glossy, less than 2.5 mm, <i>Aquilegia</i> <i>vulgaris</i> L. 2026	
23	(7) Seed with tines, spikes, seta, cup-shaped tips or cup-shaped fimbriae at the crown .....	24
-	Seed with tines, spikes, prickles or hairs on the surfaces or with tines on the continuation of edges or corners .....	41
24	Seed at the summit with two or more spikes or tines .....	25
-	Seed at the summit with cup-shaped tips or fimbriae, or with dense setae or awns .....	29
25	Seed with two or three dispersed tines at the tip .....	26
-	Seed differently .....	27
26	Tines in the top angle dispersed, <i>Sida spinosa</i> L. 1669	
-	Tines almost horizontally dispersed, <i>Spinaci</i> <i>oleracea</i> L. 239	
27	Seed in the center of the summit with pointed cone or elongated beak .....	28
-	Summit convex, without tips in the center, <i>Tetragonia tetragonoides</i> O. K. Pall. 21	
28	Seed more than 5 mm, wider than 4 mm (without prickles) <i>Ambrosia trifida</i> L. 259	
-	Seed smaller than 5 mm (not tippy), narrower than 3 mm, <i>Ambrosia artemisiifolia</i> L. 258	
29	(24) Seed at the summit with seta or awns .....	30
-	Seed with cup-shaped tips or fimbriae .....	31



30	Seed at the summit with a crown with about 2 mm long setas, surface dark olive-green, <i>Agrimonia eupatoria</i> L. 2092	
-	Seed upward with about 15 awns of more than 10 mm in length, <i>Aegilops ovata</i> L. 906	
31	Seed at the summit with cup-shaped tips .....	32
-	Seed at the summit with cup-shaped fimbriae .....	39
32	Surface covered with Squamas .....	33
-	Surface bare or Crinite .....	34
33	Squamas standing dense, seed surface totally thickened, not arranged in clear rows, <i>Eryngium campestre</i> L. 2445	
-	Squamas standing loose, seed surface between the squamas + prominent, <i>Eryngium planum</i> L. 2447	
34	Seed at the summit with five cup-shaped tips ....	35
-	Seed at the summit with 3 or 4 cup-shaped tips ..	37
35	Calyx bared .....	36
-	Calyx short crinite, <i>Satureja acinos</i> (L.) Scheele 1257	
36	Calyx end pointed, without membranous border, <i>Scleranthus annuus</i> L. 189	
-	Calyx end blunt, membranous border, <i>Scleranthus perennis</i> L. 190	
37	Seed with four pointed calyces .....	38
-	Seed with three pointed calyces (rarely the central tip becomes two times irregularly divided), <i>Sherardia arvensis</i> L. 2185	
38	Seed bared, <i>Alchemilla vulgaris</i> L. 2096	
-	Seed setiform crinite, <i>Alchemilla arvensis</i> (L.) Scap. 2094	
39	(31) Seed with 10 ribs, five of which carry tines, <i>Armeria maritima</i> (Mill.) Willd. var <i>elongata</i> (Hoffm.) Mansf. 1876	
-	Seed with eight ribs .....	40



40	Calyx with fimbriis shorter than the embryo, Scabiosa Columbaris L. 796	
-	Calyx fimbriis longer or of same length as embryo, Scabiosa maritima L. 797	
41	(23) Seed with short or long tines as continuations of eight edges or corners .....	42
-	Seed also on the surface with tines, prickles or hairs .....	47
42	Seed with 2 long prickles, Spinacia oleracea L. 239	
-	Seed with more than two prickles or with short tines .....	43
43	Surface deeply excavated .....	44
-	Surface not deeply excavated .....	45
44	Seed smaller than 5 mm, Emex spinosa Campd. 1905	
-	Seed bigger than 5 mm, Emex australis Steinh. 1904	
45	Seed with a $\pm$ straight beak .....	46
-	Seed with highly curved close to each other beaks, Adonis vernalis L. 2001	
46	Beak tip blackish, Adonis flammeus Jacq, 2000	
-	Beak tip light, Adonis aestivalis L. 1999	
47	(41) Seed three-edged, dorsal surface arched, two sides flat or seed in cross-section wedge- shaped .....	48
-	Shape differently .....	49
48	Central rib coarsely nodulated, Tribulus terrestris L. 2511	
-	Surface with three smooth ribs, which terminate in long prickles, Pavonia spinifex Cav. 1668	
49	Prickles with barb .....	50
-	Prickles without barb .....	53
50	Seed more than 5 mm .....	51
-	Seed less than 4 mm, Lappula echinata Gilib. 96	
51	Seed oval .....	52
-	Seed $\pm$ flat compressed, xanthium spinosum L. 556	





52	Surface between prickles with fine short hairs, gray-green, <i>Xanthium strumarium</i> L. 557	
-	Surface between prickles fine setiform, brown, <i>Xanthium riparium</i> Itzigs. et Hertsch em Lasch 555	
53	Prickles longer than 3 mm .....	54
-	Prickles shorter than 3 mm, <i>Onobrychis</i> <i>viciaefolia</i> Scop. 1461	
54	<i>Cenchrus tribuloides</i> L. 967	
-	<i>Cenchrus spec.</i>	
55	(2) Hilum grooved, surrounded by protruding ring, with a central uvula, which can be broken in seed corn .....	56
-	Hilum not grooved, mostly without protruding ring, straight or arched .....	63
56	Seed longer than wide .....	57
-	Seed wider than high .....	59
57	Seed more than 10 mm, surface yellow to light brown, shape long and pointed, <i>Cakile maritima</i> Scop. 671	
-	Seed smaller than 8 mm .....	58
58	Surface dark gray to black, with irregular longitudinal ribs, which become nodular towards the tip, <i>Borago officinalis</i> L. 88	
-	Surface brown to dark-brown, with hard, anastomosing ribs, <i>Anchusa azurea</i> Mill. 84	
59	Surface lusterless, yellow-gray to gray-brown, reticular- wrinkled, ribbed, <i>Uvula</i> slightly lighter than the surface .....	60
-	Surface brown to blackish, glossy or lusterless, smooth or delicate granulated, <i>Uvula</i> clearly lighter than the surface .....	62
60	Seed with a blunt end (laterally viewed) .....	61
-	Seed with a pointed end (laterally viewed), <i>Lycopsis arvensis</i> L. 99	



61	Surface with numerous thick ribs, <i>Achusa officiuialis</i> L.86	
-	Surface with fewer and weaker ribs, <i>Achusa ochroleuca</i> M.B. 85	
62	Surface highly glossy, almost smooth, <i>Symphytum officinale</i> L. 106	
-	Surface weakly glossy, delicate granulated, <i>symphytum asperum</i> Lepech. 105	
63	(55) Surface smooth .....	64
-	Surface rough .....	66
64	Surface glossy as porcelain, rose-white, <i>Lithospermum officinale</i> L. 98	
-	Surface dark-gray to brown .....	65
65	Seed more than 5 mm, <i>Cerithe maior</i> L. 89	
-	Seed less than 5 mm, <i>Cerithe minor</i> L. 90	
66	Hilum arched, <i>Lithospermum arvense</i> L. 97	
-	Hilum flat	
67	Seed more than 10 mm, <i>Cakile maritima</i> Scap. 671	
-	Seed less than 10 mm	
68	Surface granulated to warty, <i>Echium vulgare</i> L. 93	
-	Surface weakly glossy, nodulated or with short prickles, <i>Echium italicum</i> L. 92	
69	(4) Seed in a sheath (Shell, Capsule or utricle) or lamellated Nusk .....	70
-	Seed not fixed in a sheath .....	84
70	Seed barrel-shaped or cylindrical, or compressed banel-shaped .....	71
-	Seed differently .....	73
71	Seed compressed .....	72
-	Seed barrel-shaped or cylindrical, <i>Raphanus raphanistrum</i> L. 711	
72	Seed bigger than 2.5 mm, <i>Ornithophus sativus</i> Brot. 1466	
-	Seed smaller than 2.4 mm, <i>Ornithophus perpusillus</i> L. 1465	



73	Seed in one or several membranous sheath, can be easily compressed .....	74
-	Seed in a woody sheath .....	78
74	Seed in several membranes (= lamellated husk). Smells like garlic .....	75
-	Seed in one membrane (utricle) .....	76
75	Seed thick ventricose, surface brown-violet, <i>Allium schoenoprasum</i> L. 1560	
-	Seed ovoid pointed, sloped. Surface straw-colored to yellowish-reddish, <i>Allium vineale</i> L. 1564	
-	<i>Allium oleraceum</i> L. 1556	
76	Seed thick and ventricose, with short beak, <i>Carex panicea</i> L. 722	
-	Seed long and tipped, with long beak .....	77
77	Surface yellow, <i>Carex flava</i> L. 769	
-	Surface gray-brownish, <i>Carex silvatica</i> Huds. 774	
78	(73) Seed smaller than 2.5 mm $\pm$ spherical with one clear or two unclear farrows, <i>Valerianella rimosa</i> Bast. 2492	
-	Seed bigger than 2.5 mm .....	79
79	Seed bigger than 10 mm .....	80
-	Seed smaller than 10 mm .....	81
80	Seed four-sided, pointed at one end, <i>Cakile maritima</i> Scop. 671	
-	Seed sloped, two-winged, <i>Isatis tinctoria</i> L. 698	
81	Seed slightly flattened, club-shaped to pear-shaped, thick end inflated on both sides, with mounted tip in the center, <i>Myagrum perfoliatum</i> L. 709	
-	Seed $\pm$ spherical to pointed-oval .....	82
82	Seed with longitudinal ribs .....	83
-	Seed without ribs, bigger than 5 mm, <i>Bunias orientalis</i> L. 670	
83	Seed almost spherical, ribs nodular, <i>Rapistrum rugosum</i> (L.) All. 715	
-	Seed pointed-oval, ribs smooth, <i>Rapistrum perenne</i> (L.) All. 714	



84	(69) Seed with a tip, white or yellowish appendix at the point of attachment; or seed with a caruncle and delicate-longitudinal fissure at the keeled side (Caruncle eventually broken) or seed with projecting, ring-shaped hilum, seed always smaller than 5 mm .....	85
-	Hilum without white appendix a seed differently..	97
85	Seed with a tip, whitish or yellowish appendix..	86
-	Seed longitudinally grooved or with fine longitudinal fissure and Caruncle or hilum prominent ring-shaped .....	89
86	Surface occupied with white warts, <i>Lamium purpureum</i> L. 1212	
-	Surface without warts .....	87
87	Surface chestnut-brown, <i>Prunella grandiflora</i> (L.) Sacq. 1235	
-	Surface lighter .....	88
88	Seed bigger than 2.2 mm, <i>Prunella laciniata</i> L. 1236	
-	Seed smaller than 2.0 mm, <i>Prunella vulgaris</i> L. 1237	
89	Hilum prominent ring-shaped .....	90
-	Hilum differently .....	91
90	Hilum protruding, seed broader than 2.0 mm, <i>Fumaria officinalis</i> L. 1778	
-	Hilum membranous, seed narrower than 2.0 mm, <i>Fumaria Schleicheri</i> Soyer. Willem 1779	
91	Surface smooth .....	92
-	Surface rough or ribbed .....	94
92	Seed bigger than 2.0 mm .....	93
-	Seed smaller than 2.0 mm, surface yellow, <i>Euphorbia palychroma</i> Kern. 838	
93	Seed elongated, egg-shaped, <i>Euphorbia glareosa</i> M.B. 833	
-	Seed thick-oval, <i>Euphorbia lucida</i> Waldst. et, Kit. 835	





94	Surface with dimples or diagonally ribbed .....	95
-	Surface warty or wrinkled .....	96
95	Surface diagonally ribbed, with diagonally elongated dimples, <i>Euphorbia falcata</i> L. 832	
-	Surface with round or elongated dimples, <i>Euphorbia peplus</i> L. 836	
96	Seed with smooth, roundish borders, which slightly lighter than the gray-brown to black surface, <i>Euphorbia preslii</i> Guss 839	
-	Seed with sharp borders, of same color as the surface, <i>Euphorbia exigua</i> L. 831	
97	(84) Seed ± Spherical to Cubic with round edges, surface smooth or wrinkled, hilum beside the depression, in which lies the hypocotyl .....	98
-	Seed differently .....	99
98	<i>Pisum sativum</i> L. subsp. <i>hortense</i> (Neilr.) A. et Gr. 1479	
-	<i>Pisum sativum</i> L. subsp. <i>arvense</i> (L.) A. et Gr. 1478	
99	Seed bigger than 5.0 mm .....	100
-	Seed smaller than 5.0 mm .....	116
100	Seed with a projecting hypocotyl .....	101
-	Hypocotyl not projecting .....	102
101	<i>Cicer arietinum</i> L. Var. <i>fuscum</i> Alef. 1334a	
-	<i>Cicer arietinum</i> L. Var. <i>album</i> Gaudin. 1334b	
102	Seed grooved at one or all sides .....	103
-	Seed not grooved, oval to almost circular in contour .....	106
103	Seed grooved on all three sides, <i>Fagopyrum tataricum</i> Gaertn. 1907	
-	Seed grooved on one side .....	104
104	Seed thick, ventricose .....	105
-	Seed elongated spike-shaped, <i>Secale cereale</i> L. 1087	



105	Seed with narrow furrow at ventral surface, Hordeum vulgare L. convar. distichon Alef. 1032	
-	Hordeum vulgare L. convar. hexastichon Alef. 1033	
-	Seed with deeper furrow at ventral surface, Triticum aestivum L. em. Fiori et Paol. 1110	
106	Seed typical lenticular, disc-shaped with sharp border, Lens culinaris Med. 1405	
-	Seed oval to round or edged .....	107
107	Seed oval, one end round, the other one + pointed .....	108
-	Seed edged, axe-shaped or circular in shape, both upper sides sloped .....	112
108	Seed with a basin-shaped deepening at one surface, Zea mays L. var. dentiformis Kcke. 1131	
-	Seed differently .....	109
109	Seed with a small crown, Cnicus syriacus Roth. 359	
-	Seed without crown .....	110
110	Surface lusterless, spotted gray-black .....	111
-	Surface gray, glossy, seed thick-oval, Cannabis sativa L. 1675	
111	Lateral surfaces convex, Bryonia dioica Jacq. 731	
-	Lateral surfaces + sloped, Bryonia alba L. 730	
112 (107)	Seed edged, almost axe-shaped .....	113
-	Seed differently, almost circular in contour ....	114
113	Seed (sharp-edged), Lathyrus sativus L. 1398	
-	Seed (blunt-edged) Lathyrus cicera L. 1387	
114	Seed with oval, dimple-shaped hilum, Lupinus albus L. 1413	
-	Seed with broader basin-shaped deepening at the upper side .....	115
115	Surface glossy as far as the embryo, Zea mays L. var. vulgaris Kcke. 1134	
-	Surface lusterless, Sorgum bicolor (L.) Moench 1097	



116	(99)	Surface smooth .....	117
-		Surface not smooth .....	150
117		Seed bigger than 3 mm .....	118
-		Seed smaller than 3 mm .....	127
118		Seed with germ suture, <i>Geranium pratense</i> L. 881	
-		Seed without germ suture .....	119
119		Seed thick-oval or thick spindle-shaped .....	120
-		Seed lenticular or sloped spherical or axe-shaped	122
120		Seed thick-oval .....	121
-		Seed thick, spindle-shaped, <i>Thalictrum aquilegifolium</i> L. 2072	
121		Surface glossy, gray, <i>Cannabis sativa</i> L. 1675	
-		Surface lusterless spotted gray-black, <i>Bryonia dioica</i> Jacq. 731	
122		Seed lens-shaped .....	123
-		Seed sloped, spherical eventually with tip or axe-shaped .....	124
123		Seed with sharp edge, <i>lens culinaris</i> Med. 1405	
-		Seed with blunt edge, <i>Vicia sativa</i> L. subsp. <i>obovata</i> (Ser.) Gaud. var. <i>leucosperma</i> (Moensch) ser. 1538	
124		Seed sloped spherical .....	125
-		Seed axe-shaped, <i>Lathyrus cicera</i> L. 1387	
125		Surface black, <i>Asparagus officinalis</i> L. 1574	
-		Surface lighter, at one upper side with basin-shaped depression .....	126
126		Surface glossy as far as the embryo, <i>Zea mays</i> L. var. <i>vulgaris</i> Kcke. 1134	
-		Surface lusterless, <i>sorgum bicolor</i> (L.) Moench 1097	
127	(117)	Hilum at the tip .....	134
-		Hilum lateral to the tip or on one side .....	128
128		Seed with cryotals on the surface, <i>Lycopus europaeus</i> L. 1218	
-		Seed without crystals on the surface .....	129



129	Seed sloped .....	130
-	Seed not sloped, with clear germ suture ....	132
130	Surface dark-brown to black .....	131
-	Surface reddish-gray, farina coated, <i>Plantago coronopus</i> L. 1860	
131	Surface longitudinally streaked against light, <i>Plantago maior</i> L. 1865	
-	Surface granulated against light, <i>Plantago rugelii</i> Decne. 1870	
132	Seed broad-oval in shape, <i>Geranium molle</i> L. 880	
-	Seed elongated-oval in shape .....	133
133	Seed mostly 2 mm in size, surface light red-brown, <i>Geranium rabertianum</i> L. 883	
-	Seed mostly 1.8 mm in size, surface reddish-gray, <i>Geranium pusillum</i> L. 882	
134 (127)	Surface glossy to highly glossy .....	135
-	Surface lusterless .....	147
135	Seed in contour celiptical to oval .....	136
-	Seed Circular in shape with or without tip, or rounded three-cornered .....	140
136	Seed slightly keeled at one side, <i>Palygonum hydropiper</i> L. 1913	
-	Seed differently .....	137
137	Seed winged at one edge, <i>Aquilepia vulgaris</i> L. 2026	
-	Seed with rings all around + sharp border ..	138
138	Seed ovoid, hilum at broad end .....	139
-	Seed elliptical, surface gold-brown, <i>Specularia speculum-veneris</i> (L.) DC. 154	
139	Keel clear, seed usually bigger than 1.2 mm, <i>Myosotis arvensis</i> (L.) Hill 100	
-	Keel unclear, seed smaller than 1.2 mm, <i>myosotis micrantha</i> Pall. 101	
140 (135)	Seed almost circular in shape with mounted tip	141
-	Seed circular in shape without tip .....	143





141	Both sides sloped and slightly deepened, Polygonum lapathifolium L. 1914	
-	One on both sides arched laterally or Carinate..	142
142	Both sides arched almost of same height, one side slightly keeled, the other one arched, surface very smooth when examined closely (under a magnifying glass, Polygonum minus Huds 1915	
-	The keeled side slightly higher arched, surface fine, rough under magnifying glass, Polygonum persicaria L. 1916	
143	Seed almost Circular in shape with small, mostly blunt angular indent, Celosia argentea L. 31	
-	Seed almost circular in shape with small pointed angular indent at hilum .....	144
144	Seed more oval in shape, about 1 mm long, Amaranthus deflexus L. 26	
-	Seed more circular in shape .....	145
145	Seed usually 1.2 mm in diameter .....	146
-	Seed usually smaller than 1.2 mm, Amaranthus retroflexus L. 29	
146	Amaranthus lividus L. 28	
-	Amaranthus spec.	
147 (134)	Seed two to three-edged or multi-edged, surface cocoa-colored Lysimachia vulgaris L. 1960	
-	Seed differently .....	148
148	Seed with diagonally placed, prominent hilum at round end .....	149
-	Hilum differently .....	150
149	Alchemilla arvensis (L.) Scop. 2094	
-	Alchemilla spec	
150 (116)	Surface covered with membranous squama or Carina	151
-	Surface differently .....	152
151	Seed with undulating rows of squamas, Delphinium consolida L. 2044	
-	Seed with wavy unstraight carina, Delphinium ajacis L. 2039	



152	Surface longitudinally ribbed .....	153
-	Surface differently .....	163
153	Seed ± spherical .....	154
-	Seed not spherical .....	156
154	Seed more than 2.5 mm .....	155
-	Seed less than 2.5 mm, <i>Valerianella rimosa</i> Bast. 2492	
155	Ribs nodulated, <i>Rapistrum rugosum</i> (L.) All. 715	
-	Ribs smooth, <i>Rapistrum perenne</i> (L.) All. 714	
156	Seed lenticular .....	157
-	Seed not lenticular .....	158
157	Surface crinite, calyx edge forms an opening of about 1 mm wide, <i>Valerianella eriocarpa</i> Desv. 2490	
-	Surface not crinite, Calyx edge forms an opening about 5 mm wide, <i>Valerianella dentate</i> (L.) Poll. 2489	
158	Seed bigger than 2 mm .....	159
-	Seed smaller than 2 mm .....	160
159	Seed ventricose, three-edged, <i>Smyrniun perfoliatum</i> L. 2473	
-	Seed elongated-ovoid, <i>Alliaria officinalis</i> Andrz. 634	
160	Surface with smooth ribs .....	161
-	Surface with nodulated ribs .....	162
161	<i>Euphrasia officinalis</i> L. em. Hayne 2270	
-	<i>Euphrasia spec</i>	
162	<i>Scrophularia peregrina</i> L. 2315	
-	<i>Scrophularia spec.</i>	
163 (152)	Seed with multiple corners .....	164
-	Seed differently .....	177
164	Seed shaped like an orange-slice .....	165
-	Seed irregular or ovoid, three-edged .....	167
165	Surface black .....	166
-	Surface lighter, dark gray to dark brown, <i>Ruta</i> <i>gravealens</i> L. 2198	



166	Surface with undulating folds diagonal in Course, <i>Nigella damascena</i> L. 2056	
-	Surface rough-granulated, without folds, <i>Nigella sativa</i> L. 2059	
167	Seed irregular, sharp-cornered .....	168
-	Seed ovoid in shape, three-cornered .....	176
168	Surface black to gray-black .....	170
-	Surface brown, seed smaller than 2 mm .....	169
169	<i>Oenothera biennis</i> L. 1729	
-	<i>Oenothera spec.</i>	
170	Surface nodulated- and wrinkled-rough .....	171
-	Surface $\pm$ folded .....	173
171	Seed bigger than 2.5 mm .....	172
-	Seed smaller than 2.5 mm. <i>Albium schoenoprasum</i> L. 1560	
172	Seed sharp-edged, surface brown-black, <i>Ornithogalum pyramidale</i> L. 1623	
-	Seed blunt-edged, surface weakly lustrous, <i>Ornithogalum pyrenaicum</i> L. var. <i>sphaerocarpum</i> (Kern.) A. et. Gr. 1624	
173	Surface slightly folded, glossy .....	174
-	Surface highly folded, lusterless .....	
174	Seed thin, <i>Allium schoenoprasum</i> L. 1560	
-	Seed thick, <i>Allium cepa</i> L. 1553	
175	Surface close-excavated folded, <i>Allium</i> <i>caeruleum</i> Pall. 1552	
-	Surface widely excavated, folded, <i>Albium porrum</i> L. 1557	
176 (167)	Seed bigger than 3.5 mm, <i>Fagopyrum tataricum</i> Gaertn. 1907	
-	Seed smaller than 3 mm, <i>Polygonum hydropiper</i> L. 1913	
177	Seed almost oval, with raised germ suture ...	178
-	Seed without raised germ suture .....	182
178	Surface with concentric arranged facets ....	179
-	Surface without concentric arranged facets...	180



179	Surface Coarse-reticular, with nearly quadratic facets, <i>Glaucium corniculatum</i> (L.) Curt. 1780	
-	Surface delicate; reticular, with right-angled facets, <i>Glaucium flavum</i> Cr. 1781	
180	Seed bigger than 2.5 mm, <i>Geranium pratense</i> L. 881	
-	Seed smaller than 2.5 mm	
181	Surface with hexagonal net, <i>Geranium dissectum</i> Jusl. 878	
-	Surface with irregular square to hexagonal net, <i>Geranium columbinum</i> L. 877	
182	(177) Surface black-brown to black .....	183
-	Surface lighter .....	193
183	Seed spherical to sloped-spherical or compressed lenticular .....	184
-	Seed elongated .....	191
184	Seed sloped or compressed on both sides, keeled all around .....	187
-	Seed spherical or only sloped on one side .....	185
185	Seed sloped at one side, hilum in the center of the sloped side, <i>Asparagus officinalis</i> L. 1574	
-	Seed almost spherical .....	186
186	Hilum light, <i>Muscari comosum</i> Mill. 1621	
-	Hilum dark, <i>Ornithogalum comosum</i> Torner 1622	
187	Seed diameter bigger than 3 mm, <i>Salsola soda</i> L. 238	
-	Seed smaller than 3 mm .....	188
188	Seed circular in shape with spike .....	189
-	Seed circular without spike .....	190
189	Both sides compressed, <i>Polygonum lapathifolium</i> L. 1914	
-	Both sides + arched, <i>Polygonum bugeanum</i> Turcz. 1910	
190	Seed bigger than 1.6 mm, <i>Chenopodium hybridum</i> L. 228	
-	Seed smaller than 1.5 mm, <i>Chenopodium murale</i> L. 229	





191	(183)	Seed egg wedge-shaped, <i>Iva xanthifolia</i> Nutt 446	
-		Seed elongated, with light apex .....	192
192		Seed broader than 20 mm, <i>Melampyrum arvense</i> L. 2288	
-		Seed narrower than 1.9 mm, <i>Melampyrum pratense</i> L. 2289	
193	(182)	Dorsal surface slightly arched, the other surface surrounded with Carinate, deeper, vat-like longitudinal furrow, <i>Antirrhinum orontium</i> L. 2250	
-		Seed without longitudinal furrow .....	194
194		Dorsal surface equally highly arched, the other surface domed, also compressed, edges roundish.	195
-		Seed differently .....	199
195		Surface dark-red, glossy, <i>Minuartia peploides</i> (L.) Hiern 187	
-		Surface differently .....	196
196		Surface of longitudinal ribs on the dorsal surface, <i>Smyrniium perfoliatum</i> L. 2473	
-		Surface rough-wrinkled to + warty .....	197
197		Surface rough-wrinkled, <i>Convolvulus arvensis</i> L. 568	
-		Surface nodulated-warty .....	198
198		<i>Convolvulus elongatus</i> Willd. 569	
-		<i>Convolvulus tricolor</i> L. 572	
-		<i>Convolvulus undulatus</i> Cav. 573	
199	(194)	Seed elongated, slightly round, three-cornered, pointed at both ends, more than 2.5 mm .....	200
-		Seed differently .....	201
200		<i>Thalictrum equilegifolium</i> L. 2072	
-		<i>Thalictrum spec.</i>	
201		Seed ovoid, more than 3 mm .....	202
-		Seed smaller .....	210
202		Seed with perigon residue at upper end, pedunculate at the base .....	203
-		Seed differently .....	204
203		Surface with flat, widely placed longitudinal veins, <i>Thesium linophyllum</i> L. 2209	
-		Surface with close placed higher longitudinal veins, <i>Thesium ramosum</i> Hayne 2210	



204	Surface glossy red, <i>Minuartia peploides</i> (L.) Hiern	187
-	Surface lusterless .....	205
205	Seed ovoid, with a Carina all around .....	206
-	Seed without Carina all around .....	207
206	Lateral surfaces arched, <i>Bryonia dioica</i> Jacq.	731
-	Lateral surfaces $\pm$ sloped, <i>Bryonia alba</i> L.	730
207	Surface gray-yellow to gray-green .....	208
-	Surface darker .....	209
208	Seed with broader membranous tip, <i>Adonis vernalis</i> L.	2001
-	Seed with pointed hilum, <i>Spinacia oleracea</i> L.	239
209	Surface gray, <i>Commelina communis</i> L.	246
-	Surface black-brown, <i>Commelina coelestis</i> Willd.	245
210(201)	Seed egg-, wedge-shaped or $\pm$ spherical .....	215
-	Seed irregular (polyhedral) .....	211
211	Surface yellowish, <i>Lysimachia vulgaris</i> L.	1960
-	Surface darker .....	212
212	Seed bigger than 2 mm .....	213
-	Seed smaller than 2 mm .....	214
213	Surface gray, <i>Commelina communis</i> L.	246
-	Surface black-brown, <i>Commelina coelestis</i> Willd.	245
214	Surface deeply-excavated reticular, <i>Antirrhinum</i> <i>mains</i> L.	2248
-	Surface rough, <i>Oenothera biennis</i> L.	1729
215(210)	Seed egg-, wedge-shaped .....	216
-	Seed $\pm$ spherical .....	217
216	Seed bigger than 2 mm, surface brown to black, <i>Iva xanthiifolia</i> Nutt	446
-	Seed about 1 mm size, surface light gray, <i>Artemisia</i> <i>annua</i> L.	284
217	Surface fine to coarse reticular .....	218
-	Surface rough .....	220
218	Surface Coarse reticular, seed almost spherical...	219
-	Surface fine reticular, seed flattened, <i>Atropa</i> <i>belladonna</i> L.	2344



219	Surface simple-shaped, <i>Neslia paniculata</i> (L.) Desv. 710	
-	Surface with irregular facets, <i>vogelia apiculata</i> (Fisher, Mey, et Lallemand.) Vierh. 727	
220	Surface red-brown .....	221
-	Surface gray to yellow and light-brown .....	223
221	Seed bigger than 2 mm, <i>lanchicum autumnale</i> L. 1588	
-	Seed smaller than 2 mm .....	222
222	<i>Eleusine coracana</i> (L.) Gaertn. 988	
-	<i>Eleusine indica</i> (L.) Gaertn. 989	
223	Hilum at the top of the ventral surface, light, clear, <i>Heliotropium europaeum</i> L. 95	
-	Hilum at other location .....	224
224	Seed bigger than 2.0 mm .....	225
-	Seed smaller than 2.0 mm .....	226
225	Surface gray, hilum at the tip, <i>Spinacia</i> <i>oleracea</i> L. 239	
-	Surface yellow to light brown, hilum with reddish spot at the ventral surface, <i>Cuscuta</i> <i>lupuliformis</i> Krockner 581	
226	Seed smooth compressed, mostly with small diagonal spike, <i>Ranunculus sceleratus</i> L. 2069	
-	Seed irregular spherical .....	227
227	<i>Cuscuta epithimum</i> (L.) Murr. 577	
-	<i>Cuscuta epilinum</i> Weihe 576	
-	<i>Cuscuta europaea</i> L. 579	



Group VII B

1	All three surfaces are of nearly the same size and same shape .....	2
-	The three surfaces are not of the same size or shape .....	22
2	Seed with basal, long seta .....	3
-	Seed without basal seta .....	4
3	Seed more than 2.0 mm, surface gray-brown, live <i>scirpus lacustris</i> L. 782	
-	Seed smaller than 1.5 mm, surface yellowish-white, <i>Scirpus silvaticus</i> L. 784	
4	Surface smooth .....	5
-	Surface rough .....	20
5	Seed bigger than 3 mm .....	6
-	Seed smaller than 3 mm .....	12
6	Seed with long beak .....	7
-	Seed without beak .....	8
7	<i>Carex silvatica</i> Huds 774	
-	<i>Carex</i> spec.	
8	Surface black glossy, <i>Polygonum dumetorum</i> L. 1912	
-	Surface brown .....	9
9	Seed bigger than 4.5 mm, <i>Fagopyrum esculentum</i> Moench 1906	
-	Seed smaller than 4.0 mm .....	10
10	Surface Chestnut-brown, highly glossy, <i>Polygonum bistorta</i> L. 1909	
-	Surface light brown to brown, glossy .....	11
11	Surface brown, seed usually broader than 2 mm, <i>Rumex patientia</i> L. 1927	
-	Surface light brown, seed normally narrower than 1.8 mm, <i>Rumex scutatus</i> L. 1931	
12	(5) Seed with sharp edges .....	13
-	Seed with blunt edges, about 1.2 mm size, <i>Rumex acetosella</i> L. 1922	





13	Seed bigger than 2 mm .....	14
-	Seed smaller than 2 mm .....	17
14	Seed tipped at the top, down at the hilum blunt- angular cranked .....	15
-	Seed pointed upward and downward .....	16
15	Surface brown, <i>Rumex pulcher</i> L. 1928	
-	Surface red-brown, <i>Rumex crispus</i> L. 1925	
16	Surface light brown, <i>Rumex scutatus</i> L. 1931	
-	Surface brown, seed smaller than 2.5 mm, <i>Rumex</i> <i>abtusifolius</i> L. 1926	
17	Seed pointed at the top, down at hilum pointed ..	18
-	Seed pointed at the top, down at hilum blunt ...	19
18	Surface black-brown, with light edges, <i>Rumex</i> <i>acetosa</i> L. 1921	
-	Surface black-brown, with edges of same colour, <i>Polygonum minus</i> Huds. 1915	
19	Seed painted at the top, down at hilum almost horizontal, surface black-brown, <i>Rumex sanguineus</i> L. 1930	
-	Seed down at the hilum blunt angular, surface dark-brown, <i>Rumex conglomeratus</i> Murr. 1924	
20	(4) Seed with longitudinal furrow on both lateral sides, <i>Fagopyrum tataricum</i> Gaertn. 1907	
-	Seed with longitudinal furrow .....	21
21	Surface black, lusterless, <i>Polygonum convolvulus</i> L. 1911	
-	Surface brown to black-brown, weak glossy, <i>Polygonum hydropiper</i> L. 1913	
22	(1) Seed at one end with two divergent tines, <i>Sida</i> <i>spinosa</i> L. 1669	
-	Seed differently .....	23
23	Seed bigger than 4 mm .....	24
-	Seed smaller than 4 mm .....	25
24	Surface gray, <i>Ipomoea sibirica</i> pers. 586	
-	Surface brown to black, <i>Prarbitis purpurea</i> (L.) voigt. 587	



25	Surface reddish-yellow to dark-brown .....	26
-	Surface different, colored .....	35
26	Seed at the base becomes broad or is elongated to pointed-oval, surface weakly glossy, slightly rough .....	27
-	Surface even, lusterless .....	29
27	Seed broad at the base, <i>Polygonum aviculare</i> L. 1908	
-	Seed elongated to pointed oval .....	28
28	Seed elongated narrower than 0.8 mm, <i>Eriophorum angustifolium</i> Honck. 779	
-	Seed pointed-oval, broader than 1 mm, <i>Eriophorum vaginatum</i> L. 781	
29	Surface diagonally ribbed or diagonally grooved..	30
-	Surface reticular to rough-warty .....	32
30	Surface diagonally ribbed .....	31
-	Surface with 3-4 diagonal grooves, gray, <i>Asphodelus tenuifolius</i> Cav. 1584	
31	Surface light gray-brown, <i>Phacelia tenacetifolia</i> Benth. 1156	
-	Surface black, <i>Nigella damascena</i> L. 2056	
32	Surface light cocoa-colored, <i>Lysimachia vulgaris</i> L. 1960	
-	Surface darker .....	33
33	Seed bigger than 2 mm, <i>Androsace maxima</i> L. 1948	
-	Seed smaller than 1.5 mm .....	34
34	<i>Anagallis arvensis</i> L. 1944	
-	<i>Anagallis spec.</i>	
35	(25) Surface folded .....	36
-	Surface rough-granulated and rough-wrinkled ....	37
36	Surface slightly folded, glossy, <i>Allium schoenoprasum</i> L. 1960	
-	Surface highly folded, almost lusterless, <i>Allium porrum</i> L. 1557	
37	Hilum in the center of the ventral surface edge, <i>Ruta graveolens</i> L. 2198	
-	Hilum at the base	



- 38 Surface deep-black, weakly glistening, *Nigella*  
*sativa* L. 2059
- Surface dark-brown, raw with light borders,  
*Nigella arvensis* L. 2055

Group VII C

- 1 Hilum very noticeable, forms a white V or \ / or \_ \_ , or  
forms a roundish U-crochet ..... 2
- Hilum differently ..... 10
- 2 Seed with roundish U-Crochet at the hilum, *Cuscuta*  
*lupuliformis* Kracker 581
- Seed differently ..... 3
- 3 Seed smaller than 2.5 mm ..... 4
- Seed larger than 2.5 mm ..... 8
- 4 Seed larger than 1.5 mm ..... 5
- Seed smaller than 1.5 mm ..... 7
- 5 Surface warty-rough, at one end with a coma, *Nepeta*  
*nuda* L. 1230
- Seed without coma
- 6 Surface delicate warty, gray-brown, *Nepeta*  
*grandiflora* M.B. 1228
- Surface almost smooth, dark-brown, *Nepeta* *Cataria*  
L. 1227
- 7 Surface dark-brown, delicate warty-rough, seed  
mostly 1.4 mm in size, *Glechoma hederacea* L. 1205
- Surface brown, almost smooth, seed usually 1.2 mm  
in size, *Satureja acinos* (L.) Scheele 1257
- 8 (3) Seed elongated in shape, bigger than 4 mm,  
*Lallemantia iberica* (M.B.) f. et M. 1209
- Seed elongated in shape, smaller than 3 mm ..... 9
- 9 Hilum V-shaped, *Dracocephalum moldavica* L. 1200
- Hilum - - shaped, *Dracocephalum ruyschiana* L. 1201



10	(1)	Hilum very vig, humpbacked and occupying almost half or more of the ventral surface .....	11
-		Hilum much smaller .....	17
11		Seed almost spherical .....	12
-		Seed ovoid	
12		Surface coarse reticular-excavated, <i>Teucrium botrys</i> L. 1281	
-		Surface smooth or almost smooth .....	13
13		Surface blackish, <i>Teucrium scorodonia</i> L. 1285	
-		Surface dark-brown, <i>Teucrium chamaedrys</i> L. 1282	
14		Surface smooth, slightly glossy <i>Dennisetum glaucum</i> (L.) R.Br. 1062	
-		Surface rough-recticular to excavated .....	15
15		Seed elongated, bigger than 2.5 mm, <i>Ajuga chamaepitys</i> (L.) Schreb. 1192	
-		Seed ovoid, smaller than 2.5 mm. ....	16
16		<i>Aujga reptans</i> L. 1194	
-		<i>Ajuga genevensis</i> L. 1193	
17	(10)	The upper end of the seed is sharply truncated, it is three-cornered and sharp-edged .....	18
-		The upper end is round .....	20
18		Seed at upper end diagonally truncated, usually bigger than 3 mm, <i>Stachys officinalis</i> (L.) Trev. 1278	
-		Seed at upper end vertically truncated, smaller than 3 mm .....	19
19		Surface smooth, brown, summit not hairy, <i>Leonurus cardiaca</i> L. 1214.	
-		Surface fine rough, blackish. Summit with delicate hairs.	
-		<i>Leonorus marrubiastum</i> L. 1215.	
20		Hilum circular or formed from circular excavation	21
-		Hilum differently .....	29
21		Surface light, brown with darker veins .....	22
-		Surface brown to black without veins .....	23





22	Surface with veins, most of which have a longitudinal course, <i>Salvia sclarea</i> L. 1250	
-	Surface with anastomosing blood vessels, <i>salvia turkestanica</i> Reg. 1252	
23	Seed bigger than 2.5 mm .....	24
-	Seed smaller than 2.5 mm .....	26
24	Seed clearly edged at the sides, surface variegated, <i>Galeopsis tetrahit</i> L. 1204	
-	Seed roundish at the sides .....	25
25	Seed almost spherical, surface dark-brown, <i>Salvia officinalis</i> L. 1247	
-	Seed elongated-oval, surface gray-black, <i>Salvia viridis</i> L 1256	
26	Surface black-brown .....	27
-	Surface lighter .....	28
27	<i>Salvia verbenaca</i> L. 1254	
-	<i>Salvia pratensis</i> L. 1248	
-	<i>Salvia aethiopsis</i> L. 1239	
-	<i>Salvia nemorosa</i> L. 1246	
-	<i>Salvia spec.</i>	
28	Surface smooth, glossy, <i>Salvia verticillata</i> L. 1255	
-	Surface slightly rough, lusterless, <i>Salvia austriaca</i> Jacq. 1241	
29	(20) Hilum horseshoe-shaped or diagonally oval ....	30
-	Hilum differently .....	32
30	Hilum horseshoe-shaped, surface with small crystals, <i>Lycopus europaeus</i> L. 1218	
-	Hilum diagonally oval .....	31
31	Surface dark gray-brown, glossy, seed ovoid, <i>Lavandula officinalis</i> Chaix 1213	
-	Surface brown, lusterless, seed almost spherical, <i>Satureja vulgaris</i> (L.) Fritsch 1262	
32	Surface smooth or almost smooth .....	33
-	Surface not smooth .....	38



33	Seed smaller than 2 mm .....	34
-	Seed larger than 2 mm .....	37
34	Surface yellowish to light brown .....	35
-	Surface darker .....	36
35	Seed pointed-oval, surface yellowish-brown, Elshaltzia partini (Lepech.) Garcke 1202	
-	Seed oval, surface reddish-brown, Majorana hortensis Moench 1219	
36	Surface dark-olive to blackish-green, Satureja hortensis L. 1261	
-	Surface dark brown to black-brown, Stachys silvatica L. 1280	
37	Surface yellowish, salvia reflexa Hornem 1249	
-	Surface gray-brown to black, Ballota nigra L. 1195	
38	(32) Seed elongated-ovoid, width to length narrower than 1:2 .....	39
-	Seed broader .....	41
39	Surface gray. Lamium amplex; Caule L. 1211	
-	Surface darker .....	40
40	Hilum noticeable with whitish-gray borders, surface of same color, dark-brown, Hyossopus officinalis L. 1208	
-	Hilum not clearly distinguishable, without light borders, surface mostly gray-brown, with darker spots, Marrubium vulgare L. 1221	
41	Surface with small, white warts .....	42
-	Surface without warts .....	43
42	Warts on the surface scattered and flat, Lamium purpureum L. 1212	
-	Warts dense and higher, Lamium amplexicaule L. 1211	
43	Seed bigger than 2.5 mm .....	44
-	Seed smaller than 2.5 mm .....	45



44	Seed broad-ovoid, <i>Galeopsis ladanum</i> L. 1203	
-	Seed narrower, length to breadth 3:2, <i>Lamium album</i> L. 1210	
45	Hilum whitish, small, three cornered, surface almost black, <i>Ocimum basilicum</i> L. 1231	
-	Hilum dark or seed lighter .....	46
46	Surface yellowish-brown, <i>Elsholtzia partini</i> (Lepech.) Garcke 1202	
-	Surface gray or brown to black .....	47
47	Seed ovoid and pointed .....	48
-	Seed broad ovoid to almost circular .....	50
48	Edges sharp, especially in the upper part ....	49
-	Edges roundish, <i>Sideritis montana</i> L. 1270	
49	Seed wider than 1.3 mm, surface monotone, dark or with lighter parts against a dark background, <i>Sideritis hyssopifolia</i> L. 1268	
-	Seed narrower than 1.2 mm, surface dark or with dark spots against light background, <i>Marrubium vulgare</i> L. 1221	
50	Seed bigger than 2 mm .....	51
-	Seed smaller than 2 mm .....	53
51	Surface brown, <i>Stachys recta</i> L. 1279	
-	Surface gray to blackish .....	52
52	Edge of ventral surface sharp up to the middle, <i>Stachys germanica</i> L. 1276	
-	Edge of ventral surface domed, <i>Sideritis hyssopifolia</i> L. 1268	
53	Surface glossy, <i>Marrubium peregrinum</i> L. 1220	
-	Surface lusterless .....	54
54	Surface dotted, <i>Stachys annua</i> L. 1273	
-	Surface not dotted .....	55
55	Surface finely warty, blackish, <i>Stachys silvatica</i> L. 1280	
-	Surface finely warty, grayish, <i>Stachys arvensis</i> L. 1274	



Group VIII

(Glumaceous seeds)

1	Caryopsis with petiole or clear basal seta ....	2
-	Caryopsis with petiole or enveloped in a glume always originating from 20 or more florets .....	109
2	Lemma awned or pointed-awned .....	3
-	Lemma not awned .....	67
3	Awn in continuation of lemma .....	4
-	Awn $\pm$ attached below the tip of lemma .....	35
4	Caryopsis with a basal seta .....	5
-	Caryopsis with petiole .....	7
5	Caryopsis thicker than 3 mm, <i>Hordeum vulgare</i> L. Convar. <i>distichon</i> Alef. 1032	
-	<i>Hordeum vulgare</i> L. Convar. <i>hexastichon</i> Alef. 1033	
-	Caryopsis thinner than 3 mm .....	6
6	<i>Hordeum murinum</i> L. 1031	
-	<i>Hordeum jubatum</i> L. 1030	
7	Caryopsis with two petioles .....	8
-	Caryopsis with one petiole .....	9
8	Caryopsis without awn, bigger than 6 mm, <i>Chrysopogon gryllus</i> (Torner) Trim. 968	
-	Caryopsis smaller than 6 mm, <i>Andropogon</i> <i>ischoemon</i> L. 926	
9	Petiole thickened, button-like at the tip or dispersed disc like .....	10
-	Petiole cylindrical or conical .....	19
10	Lemma on dorsal surface sharply keeled .....	11
-	Lemma $\pm$ arched .....	12
11	Kell of lemma ciliated, <i>Dactylis glomerata</i> L. 976	
-	Kell of lemma bare, <i>Dactylis aschersoniana</i> Graebn. 975	





12	Lemma totally or partially covered with short hairs or occupied by fine warts .....	13
-	Lemma bare .....	16
13	Lemma crinite only in upper half .....	14
-	Lemma totally crinite .....	15
14	Caryopsis broader than 1.5 mm, <i>Bromus erectus</i> Huds 950	
-	Caryopsis narrower than 1 mm, <i>Vulpia myuros</i> (L.) Gmel. 1125	
15	Surface yellow, brown, Caryopsis with pointed awns, <i>cynosurus crostatus</i> L. 973	
-	Surface straw-yellow, caryopsis awned, <i>cynosurus echinatus</i> L. 974	
16	Lemma with shorter awn or with pointed awns..	17
-	Awn longer than 3 mm .....	18
17	<i>Festuca rubra</i> L. 1017, 1018	
-	<i>Festuca ovina</i> L. subsp. eu. <i>ovina</i> Hack. var. <i>vaginata</i> (Waldst. et Kit.) Hack. 1012	
18	Caryopsis broader than 1 mm, <i>Festuca gigantea</i> (L.) Vill. 1007	
-	Caryopsis narrower than 1 mm, <i>Festuca betetophylla</i> Lam. 1008	
19	(9) Petiole at the end with a knot depression or with numerous small dimples or clearly slanting anteriorly .....	20
-	Petiole at the end without depression, not slanting anteriorly .....	28
20	Petiole at the end with three small dimples, <i>Lalium tumulentum</i> L. 1044	
-	Petiole at the end with a knot depression or slanting anteriorly .....	21
21	Petiole and base crinite or Lemma covered with fine, short or long cilia .....	22
-	Petiole bare .....	26



22		Caryopsis broader than 1.5 mm .....	23
-		Caryopsis narrower than 1.5 mm .....	24
23		Lemma with long hairs and long cilia, <i>Brachypodium silvaticum</i> (Huds.) Pal. Beauv. 943	
-		Lemma with fine, short hairs, <i>Festuca gigantea</i> (L.) Vill. 1007	
24		Lemma with long hairs, <i>Agrapylon cristatum</i> (L.) Gaertn. 908	
-		Lemma with short hairs .....	25
25		Surface straw-yellow, <i>Vulpia myuros</i> (L.) Gmel. 1125	
-		Surface gray, mostly violet run in one another, <i>Vulpiu bromoides</i> (L.) S.F. Gray 1124	
26	(2)	Caryopsis broader than 1.3 mm	
-		Caryopsis narrower than 1.2 mm, <i>Vulpia bromoides</i> (L.) S.F. Gray 1124	
27		Palea at the tip broad and blunt, <i>Brachypodium pinnatum</i> (L.) Pal. Beauv. 942	
-		Palea tipsy <i>Agrapylon repens</i> (L.) Pal. Beauv. 909	
28	(19)	Caryopsis elongated, not broader than 1.5 mm	29
-		Caryopsis almost ovoid, broader than 1.5 mm	33
29		Petioles lie dense, compressed conical .....	30
-		Petiole cylindrical .....	31
30		<i>Lalium multiflorum</i> Lam. 1039	
-		<i>Lalium multiflorum</i> Lam. var. <i>Vesterwaldicum</i> (Mansh.) Wittm. 1041	
-		<i>Lalium multiflorum</i> Lam var. <i>brasilianum</i> Nees 1040	
31		Caryopsis bigger than 6 mm, <i>Festuca gigantea</i> (L.) Vill. 1007	
-		Caryopsis smaller than 5 mm .....	32
32		Caryopsis bigger than 4 mm, <i>Festuca ovina</i> subsp. <i>eu-ovina</i> Hack. var. <i>glauca</i> (Lam.) Hack. 1011	
-		Caryopsis smaller than 4 mm, <i>Festuca ovina</i> L. subsp. <i>sulcata</i> Hack. var. <i>valesiaca</i> Koch 1014	



33	(28)	Instead of the petiolea fine, hairy basal seta, <i>Hordeum vulgare</i> L. convar. <i>distichon</i> Alef. 1032	
-		<i>Hordeum vulgare</i> L. convar. <i>hexastichon</i> Alif. 1033	
-		Caryopsis with broad compressed petiole .....	34
34		Caryopsis broader than 2 mm and almost the thickness as the breadth, <i>Lolium ternulentum</i> L. 1044	
-		Caryopsis narrower than 2 mm, remarkably flatter than it is broad, <i>Lolium remotum</i> Schrank. 1043	
35	(3)	Awns are dense below the tip of Lemma .....	36
-		Awns lie at upper third of Lemma or deeper ....	54
36		Caryopsis without awns bigger than 4 mm .....	38
-		Caryopsis without awns smaller than 4 mm .....	37
37		Awns longer than 8 mm, <i>Agrostis interrupta</i> L. 912	
-		Awns shorter than 8 mm, <i>Agrostis spica-venti</i> L. 916	
38		Palea narrower and mostly shorter than the Lemma .....	39
-		Palea and Lemma equal or almost of equal length	45
39		Caryopsis narrow and elongated, mostly not broader than 2.2 mm .....	40
-		Caryopsis broader than 2.5 mm .....	41
40		Caryopsis without-awns longer than 12 mm, <i>Bromus rigidus</i> Roth 958	
-		Caryopsis without awn smaller than 10 mm, <i>Bromus tectorum</i> L. 964	
41		Lemma with fine hairs .....	42
-		Lemma not hairy .....	44
42		Petioles with fine hairs, Lemma flat and stretched .....	43
-		Petioles bare, Lemma arched, <i>Bromus mollis</i> L. 955	
43		<i>Bromus squarrosus</i> L. 961	
-		<i>Bromus squarrosus</i> L. var. <i>wolgensis</i> Jacq. 962	



44	Palea of same length as Lemma, <i>Bromus racemosus</i> L. 956	
-	Polea clearly shorter than Lemma. Edge of Lemma transparent and membranous, <i>Bromus Japonicus</i> Thunb. 952	
45	(48) Lemma with dense and short hairs .....	46
-	Lemma bare or almost bare .....	50
46	Awns shorter than Caryopsis .....	47
-	Aws longer than the Caryopsis .....	48
47	Caryopsis compressed laterally, <i>Bromus</i> <i>carthaticus</i> Vahl. 949	
-	Caryopsis with almost flat dorsum, fruit clearly identified at the ventral surface, <i>Bromus erectus</i> Huds. 950	
48	Caryopsis without awns about 10 mm, awn almost 15 mm in length, <i>Bromus techtorum</i> L. 964	
-	Caryopsis without awns longer than 12 mm, awns about 25 mm in length and more .....	49
49	Lemma moderately compressed laterally, <i>Bromus</i> <i>medritensis</i> L. 954	
-	Lemma relatively flat and stretched, <i>Bromus</i> <i>rigidus</i> Roth. 958	
50	(45) Caryopsis flat, seed not more than 1 mm thick, <i>Bromus internis</i> Leyss. 951	
-	Lemma arched, seed thicker than 1 mm	
51	All nerves of Lemma clearly apparent, dorsum or lemma curved towards the inner side, <i>Bromus sterilis</i> L. 963	
-	Lateral nerves much thinner than the middle one of lemma, dorsum not curved towards the inner side .....	52
52	Petiole club shaped, highly curved, <i>Bromus</i> <i>secalinus</i> L. 960	
-	Petiole almost straight .....	53





53	Lemma highly compressed laterally, <i>Bromus carthaticus</i> Vahl. 949	
-	Lemme opened, <i>Bromus arvensis</i> L. 947	
54	(35) Awn originate in the upper third to the center of dorsal surface of lemma or in the lower third	55
-	Awn originate at the base of Lemma .....	65
55	Caryopsis smaller than 4 mm .....	56
-	Caryopsis bigger than 4 mm .....	60
56	Petiole and base with long hairs, hairs of same length or longer than the glumes .....	57
-	Petiole with short hairs, a hair tuft at the base or Petiole un-haired-----	58
57	Glumes fragile membranous, transparent, <i>Calamagrostis epigeios</i> (L.) Roth. 965	
-	Glumes hard, <i>Calamagrostus neglecta</i> (Ehrh.) Gartn., Mey., Scherb. 966	
58	Petiole not hairy, <i>Halcus mollis</i> L. 1028	
-	Petiole hairy (crinite) .....	59
59	Caryopsis up to 2 mm in length, <i>Aira coryphylla</i> L. 919	
-	Caryopsis up to 3 mm in length, <i>Aira praeco</i> X L. 920	
60	(55) Caryopsis 15-20 mm in length .....	61
-	Caryopsis smaller .....	62
61	Caryopsis only at the base and on the end of petiole setiform crinite, <i>Avena sterilis</i> L. subsp. <i>macrocarpa</i> (Moench) Brig. 936	
-	Caryopsis criariate up to the middle of lemma <i>Avena fatura</i> L. subsp. <i>Falua</i> (L.) Thell. 933	
62	Caryopsis more than 8 mm .....	63
-	Caryopsis less than 8 mm, <i>Trisetum flavescens</i> (L) pal. Beauv. 1109	
63	Glumes hard, <i>Avena strigosa</i> Schreb. subsp. <i>strigosa</i> (Schreb.) Thell. 939	
-	Glumes more fragile .....	64



64	Hairs on petriole stiff, fan-shaped tend to be separated from each other, 3-5 mm in length, <i>Helictotrichon pubescens</i> (Huds) pilger 1026	
-	Hairs looser, about 2 mm in length, <i>Helictotrichon pratense</i> (L.) pilger 1025	
65	(54) Awn brow in lower part, pale in upper part, thickened in the middle through a row of setas, <i>Corynephorus canescens</i> (L.) Pal, Beauv. 971	
-	Awn without thickening in the middle and of same colour .....	66
66	Caryopsis bigger than 3.5 mm, <i>Deschampoia flexuosa</i> (L.) Trin. 979	
-	Caryopsis smaller than 3.0 mm, <i>Deschampsia Caespitosa</i> (L.) Pal. Beauv. 978	
67	(2) Caryopsis with two petioles .....	68
-	Caryopsis with one petiole .....	71
68	Caryopsis broader than 2.5 mm .....	69
-	Caryopsis narrower than 2.5 mm .....	70
69	<i>Sorghum vulgare</i> pers. var. <i>saccharatum</i> Boeill. 1100	
-	<i>Sorghum vulgare</i> pers. var. <i>technicum</i> Jav. 1101	
70	<i>Sorghum halepense</i> (L.) pers. 1098	
-	<i>Sorghum halepense</i> (L.) pers. var. Sudanese Hitache. 1099	
71	Lemma long or dense and with smooth hairs, or at the base with hair tuft (fascicle) .....	72
-	Lemma not hairy, only slightly hairy in the lower third .....	74
72	Lemma with 3 mm long hairs, <i>Melica transsilvanica</i> Schur 1048	
-	Lemma differently .....	73
73	Lemma with dense and smooth hairs, <i>Elymus arenarius</i> L. 992	
-	Caryopsis at the base with hair tuft (fascicle, <i>Ammophila arenaria</i> (L.) Link 924	



74	Keels of palea thickened and protruding .....	75
-	Keels of palea neither thickened nor protruding	76
75	Caryopsis thicker than 2 mm, <i>Melica nutans</i> L.	1047
-	Caryopsis thinner than 2 mm, <i>Melica uniflora</i> Retz. 1044	
76	Lemma and palea ovoid in shape, relatively broad, Lemma slightly arched or excavated shell-like .....	77
-	Caryopsis elongated, lanceolate .....	80
77	Petioles button-like, thickened, very short, and lie almost diagonally .....	78
-	Petiole differently .....	80
78	Caryopsis broader than 3 mm, surface reddish- yellow, <i>Briza maxima</i> L. 944	
-	Caryopsis narrower than 2.5 mm. Surface yellowish gray .....	79
79	Lemma glossy, <i>Briza media</i> L. 945	
-	Lemma lusterless, <i>Briza minor</i> L. 946	
80	Lemma highly glossy .....	81
-	Lemma without high luster .....	82
81	<i>Holcus lanatus</i> L. 1027	
-	<i>Holcus mollis</i> L. 1028	
82	Lemma flat, expanded, normally pale violet, Caryopsis not more than 1 mm thick, <i>Bromus</i> <i>inermis</i> Leys. 951	
-	Lemma + keeled + domed and folded together ...	83
83	Lemma and palea at the top split from each other, petiole crinite .....	84
-	Lemma and palea do not split from each other, petiole not crinite .....	85
84	Palea extremely fragile, surface yellowish, <i>Koeleria cristata</i> pers. 1034	
-	Palea hard, surface grayish, <i>Molinia coerulea</i> (L.) Moench 1051	



85	Petiole with dimple-like depression at the end, caryopsis longer than 8 mm, <i>Agropyron repens</i> (L.) Pal. Beauv. 909	
-	Petiole without dimple like depression, Caryopsis smaller .....	86
86	Lemma with seven clearly pronounced nerves ..	87
-	Nerves not clearly pronounced or lemma with less than seven nerves .....	89
87	Caryopsis bigger than 5 mm, <i>Glyceria fluitans</i> (L.) R. Br. 1022	
-	Caryopsis smaller than 4 mm	
88	Caryopsis longer than 3 mm, <i>Glyceria spectabilis</i> Mert et K ch. 1023	
-	Caryopsis less than 2 mm, <i>Glyceria stiata</i> (Lam.) Hitchc. 1024	
89	Lemma at the top with short, white setas, <i>cynosurus cristatus</i> L. 973	
-	Lemma without setas	
90	Caryopsis bigger than 4 mm .....	90
-	Caryopsis smaller than 4 mm .....	91
91	Caryopsis with almost three edges, with slanting curved tip .....	92
-	Caryopsis not three-edged, with straight tip	93
92	Lemma at the keel ciliated with stiff hairs, <i>Dactylis glomerata</i> L. 979	
-	Lemma bare at the keel, <i>Dactylis archersoniana</i> Graebn. 975	
93	Petioles sloped, lie dense together .....	94
-	Petioles round, thin .....	95
94	Petiole at the end with three dimples, <i>Lolium</i> <i>temulentum</i> L. 1044	
-	Petiole at the end without dimples, <i>Lolium</i> <i>perenne</i> L. 1042	





95	Lemma broader than 1.5 mm. ....	96
-	Lemma narrower than 1 mm, <i>Festuca ovina</i> L. subsp. <i>eu-ovina</i> Hack. var. <i>vaginata</i> (Wladst. et, Kit.) Hack 1012	
96	<i>Festuca pratensis</i> Huds. 1015	
-	<i>Festuca arundinacea</i> Schreb 1005	
97	(90) Caryopsis whitish-yellow, glossy, <i>Cynodon</i> <i>dactylon</i> (L.) pers. 972	
-	Caryopsis grayish to grayish brown .....	98
98	Lemma with a golden yellow spot at the tip ...	99
-	Lemma without golden yellow spot .....	101
99	Lemma clearly keeled, <i>Poa pubustris</i> L. 1081	
-	Lemma slightly or unclearly keeled .....	100
100	<i>Puccinellia distana</i> (Jacq.) Parl. 1085	
-	<i>Puccinellia maritima</i> (Huds.) Parl. 1086	
101	Caryopsis bigger than 3.2 mm .....	102
-	Caryopsis smaller than 3 mm .....	103
102	Caryopsis compressed laterally, keeled, <i>poa</i> <i>chaixii</i> Vill. 1078	
-	Lemma arched, not keeled, <i>Festuca ovina</i> L. subsp. <i>en. ovina</i> Hack. var. <i>vaginata</i> (Waldst. et. kit). Hack. 1012	
103	Petiole all around with fine hairs, <i>Poa</i> <i>nemoralis</i> L. 1080	
-	Petiole not hairy .....	104
104	Keels at palea with smooth hairs, <i>Poa annua</i> L. 1076	
-	Keels of Palea dentate .....	105
105	Lemma slightly or unclearly keeled .....	106
-	Lemma clearly keeled .....	107
106	<i>Puccinellia distans</i> (Jacq.) Parl. 1085	
-	<i>Puccinellia maritima</i> (Huds) Parl. 1086	
107	Lemma usually with five clearly-distinguished nerves .....	108
-	Lemma with nerves almost invisible, <i>Poa</i> <i>compressa</i> L. 1079	



108	Sides of keeled lemma flat, tines of palea dense, 30-40 $\mu$ in length, <i>Poa trivialis</i> L. 1083	
-	Sides of keeled lemma slightly arched, tines of palea far from each other 50-60 in length, <i>Poa partensis</i> L. 1082	
109	(1) Lemma or glume awned .....	110
-	Lemma or glume not awned .....	123
110	Caryopsis still enveloped by glume .....	114
-	Caryopsis without glume, which fell down .....	111
111	Caryopsis composed of two florets (fertile "perfect", 1 sterile Caryopsis), <i>arrhenatherum</i> <i>elatius</i> (L.) S. etc. presl. 930	
-	Caryopsis single .....	112
112	Caryopsis awl-shaped, awn very long, mostly more than 30 mm long .....	113
-	Caryopsis three-cornered, awn much shorter, <i>Nardus stricta</i> L. 1052	
113	Caryopsis bigger than 14 mm, awn hairy, <i>Stipa</i> <i>pennata</i> L. 1105	
-	Caryopsis smaller than 13 mm, awn not hairy, <i>Stipa Capillata</i> L. 1104	
114	Glumes with awns .....	115
-	Glumes without awns, but only the Lemma .....	118
115	The lower glume flat and with long awns, the upper glume arched (curved) .....	116
-	Both glumes keeled and awned .....	117
116	<i>Echinochloa crus-galli</i> (L.) Pal. Beauv. 986	
-	<i>Echinochloa crus-galli</i> (L.) Pal. Beauv.-var. <i>frumentacea</i> (Roxb.) Wight 987	
117	Glumes reddish-brown, very rough hairy, glume tip dark, <i>Anthoxanthum odoratum</i> L. 928	
-	Glumes lighter brown, not roughly hairy, glume tip with broad membranous borders, light, <i>Anthoxanthum puelii</i> lecoq et Lamotte 929	



118	Glumes fused only at the base .....	119
-	Glumes fused up to the middle or more .....	122
119	Glumes bare, distended, <i>Beckmannia eruciformis</i> Host, 948	
-	Glumes ciliated or hairy, keeled .....	120
120	Glumes longer than the lemma, unequal in length.	121
-	Glumes equal or almost equal in length; the lemma are between the glumes diverging at the apex: the lemma are also equal in length to the glumes, <i>Alopecurus gniculatus</i> L. 921	
121	Glumes shortly ciliated at keel and border, the glume has only a few awns, which are curved inwards. <i>Holcus lanatus</i> L. 1027	
-	Glumes ciliated only at the Keel, awn bent, projecting between the glumes, <i>Holcus mallis</i> L. 1028	
122	Glumes with long cilia, surface whitish, <i>Alopecurus pratensis</i> L. 923	
-	Glumes with short cilia, surface yellowish, <i>Alopecurus myosuroides</i> Huds. 922	
123 (109)	Spikelet formed from numerous fixed sterile and fertile (perfect) florets, <i>Phalaris paradoxa</i> L. 1069	
-	Caryopsis differently .....	124
124	Caryopsis bigger than 8 mm .....	125
-	Caryopsis smaller than 7 mm .....	126
125	Caryopsis narrower than 2 mm, lanceolate, <i>Ammophila arenaria</i> (L.) Link 924	
-	Caryopsis broader than 3 mm, elongated, <i>Oryza</i> <i>sativa</i> L. 1053	
126	Caryopsis narrow, elongated and pointed, smaller than 2 mm and narrower than 0.5 mm, grooved on vertral surface .....	127
-	Caryopsis broader than 0.5 mm, not grooved on vertral surface .....	129



127	Palea absent or atrophied, <i>Agrostis canina</i> L. 910	
-	Palea present .....	128
128	Lemma with five fragile ribs, <i>Agrostis gigantea</i> Roth 911	
-	Lemma with three fragile ribs, <i>Agrostis tenuis</i> sibth. 918	
129	Palea and Lemma keeled and laterally compressed	130
-	Palea and Lemma not laterally compressed .....	136
130	Glumes very fragile, ribbed, lusterless, caryopsis not longer than 2 mm .....	131
-	Glumes hard, glossy or lusterless and rough ..	133
131	Caryopsis thicker than 0.8 mm, thick-ovoid in shape .....	132
-	Caryopsis thinner than 0.7 mm, elongated ovoid in shape, <i>Phleum phleoides</i> (L.) Karst. 1070	
132	Lemma densely hairy between the ribs (under higher magnification), <i>Phleum pratense</i> L. var. <i>typicum</i> Beck. 1073	
-	Lemma slightly hairy between the ribs (by higher magnification) <i>Phleum pratense</i> L. var. <i>nodosum</i> (L.) Richt. 1072	
133	Caryopsis crinite at the base or on the glumes	134
-	Caryopsis almost bare .....	135
134	Caryopsis broader than 1.5 mm, <i>Phalaris minor</i> Retz. 1068	
-	Caryopsis narrower than 1.5 mm, <i>Phalaris</i> <i>arundinacea</i> L. 1066	
135	Caryopsis bigger than 5 mm, <i>Phalaris</i> <i>carrariensis</i> L. 1067	
-	Caryopsis smaller than 4 mm, <i>Phalaris</i> <i>paradoxa</i> L. 1069	
136	(129) Palea in the central area rough or longitudinally hashured, smooth and glossy on lateral areas	137
-	Palea smooth .....	144

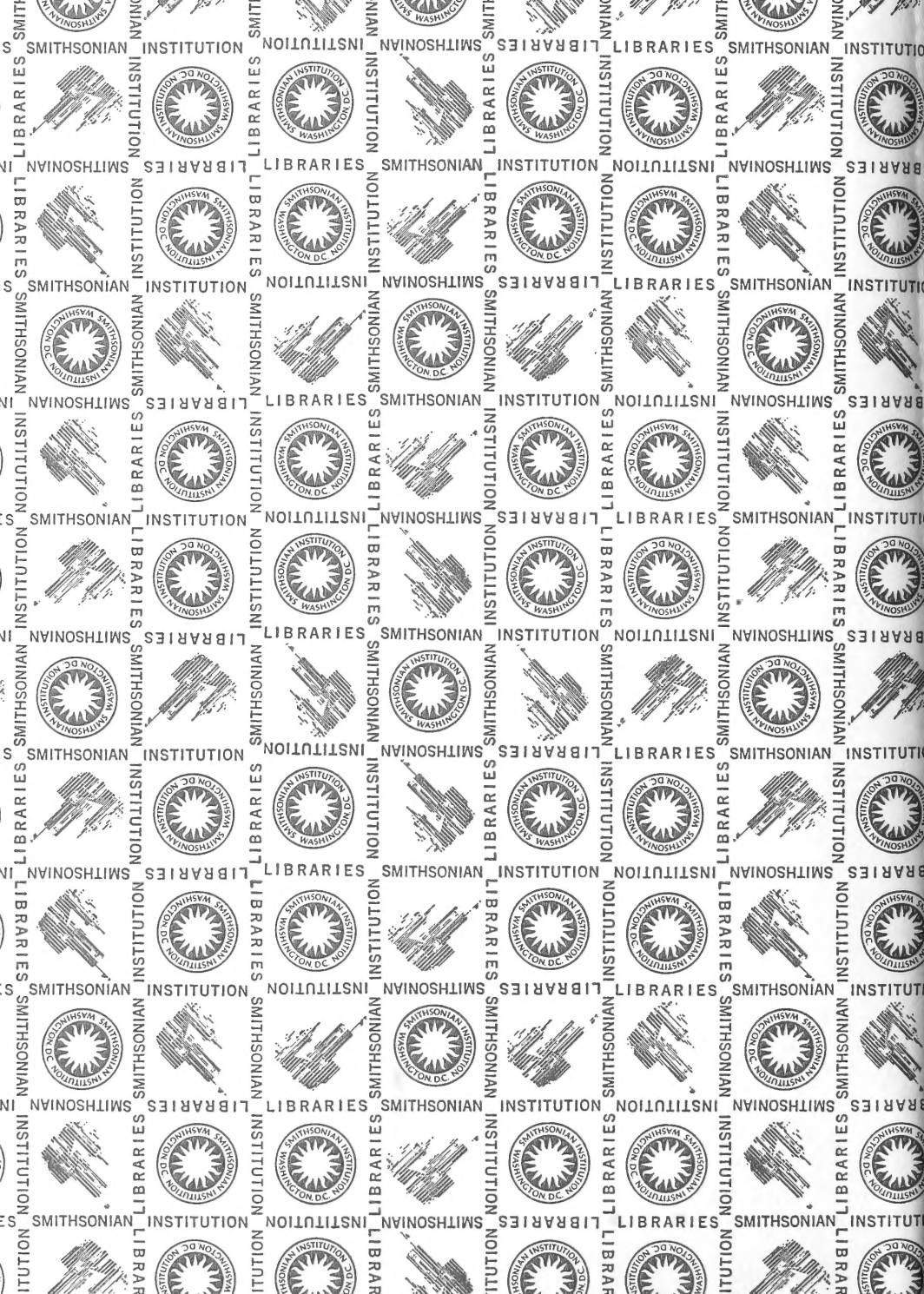


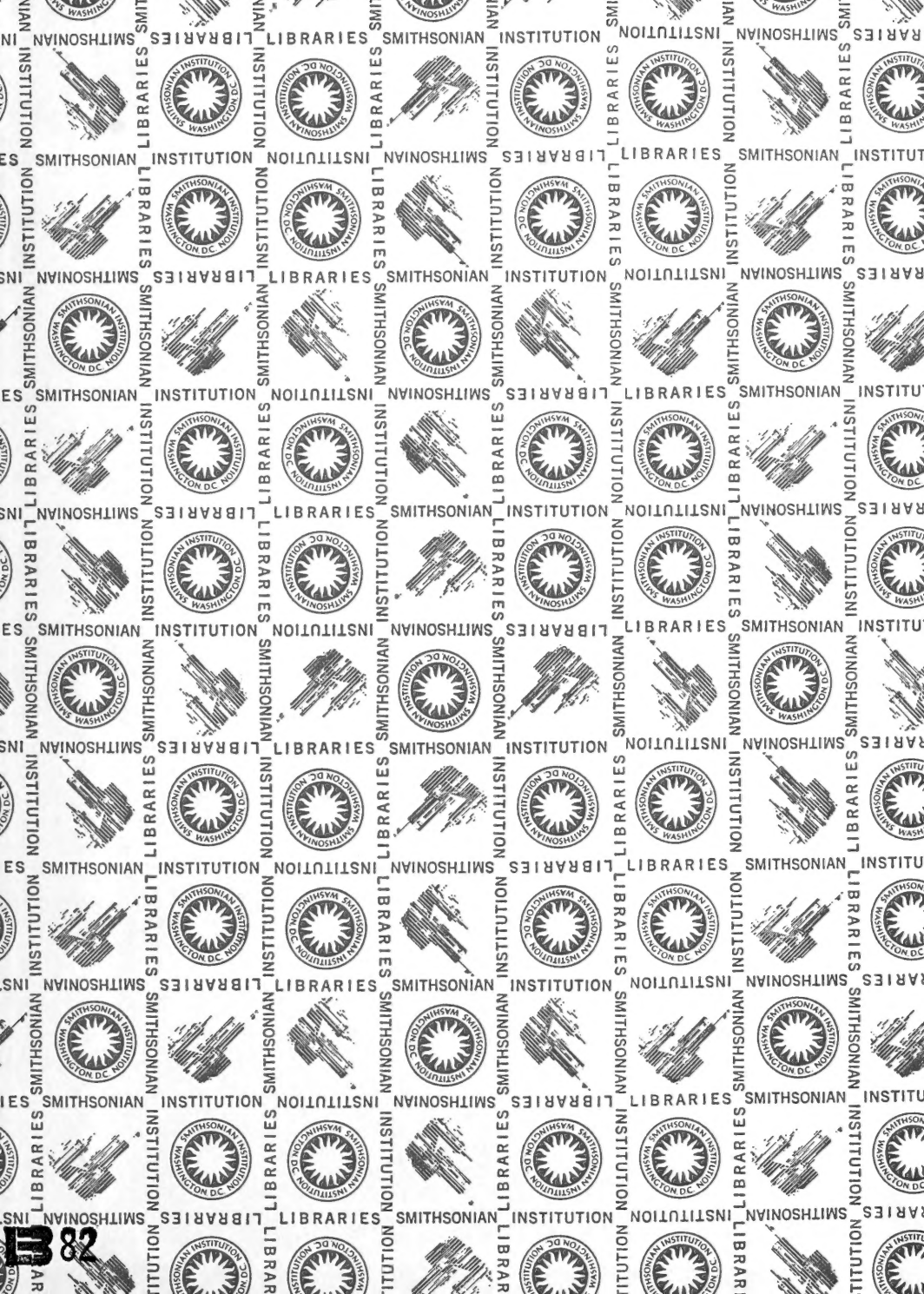


149	Lemma longitudinally delicately dotted .....	150
-	Lemma smooth .....	151
150	Surface blackish, <i>Digitaria ischaemum</i> (Schreb.) Muhl. 983	
-	Surface brownish-gray, <i>Digitaria sanguinalis</i> Scop. 984	
151	Caryopsis broader than 1.5 mm .....	152
-	Caryopsis narrower than 1.5 mm .....	154
152	Ventral surface flat .....	153
-	Ventral surface arched, <i>Panicum miliaceum</i> L.	
153	<i>Echinochloa crus-galli</i> (L.) Pal. Beauv. 986	
-	<i>Echinochloa crus-galli</i> (L.) Pal. Beauv. var. <i>frumentacea</i> (Roxb.) Wight 987	
154	Lemma with three white, weak longitudinal lines, <i>Milium effusum</i> L. 1050	
-	Lemma with five white longitudinal lines, <i>Panicum Capillare</i> L. 1055	

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