Research Article

Identification of Medicinal Plants on the Basis of Morphological Observation of Seeds in the Region of Sétif, Algeria

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ABSTRACT

Present study has been carried out on the identification of medicinal plants on the basis of morphological observation of seeds in the region of Sétif, Algeria. The analyzed characters in which the study was based on are: shape, color, size (length, width), solidity, surface, weight of 100 seeds. The results showed that seeds were laterally compressed and bilobed and showed morphological variations in size, shape, color, seed coat ornamentation. Shape of seeds showed a large variation among the investigated species. Most of seeds have elongated ovoid shape (*Linum usitatissimum* L., *Cupressus sempervirens* L., *Pinus halepensis* Mill., *Lepidium sativum* L.....) and others are Linear (*Hordum vulgare* L., *Avena sterilis* L....) or ovoid (*Rhus coriaria* L., *Salvia hispanica* L..). Color varies from yellow to brown, brown to dark brown, light creamy, white, orang, grayish, black dark and reddish. Seed dimensions vary greatly among the examined species, the largest seeds in *Cuperus rotundus* L. have a length of 12.62±0.48 mm, and the smallest seeds measure 0.75±0.11mm in *Portulaca oleracea* L. Highest weight was observed with seeds of *Zea mays* L. (1525.20±36.20 mg), while lowest weight was found in seeds of *Portulaca oleracea* L. (0.59±0.04 mg). Seed morphological characteristics proved to be useful taxonomic features, helpful in identification of large number of species and genera. Seed characters, such as shape, size and seed-coat surface, have low phenotypic plasticity and are less affected by environmental conditions. The purpose of this study was to describe and compare external seed morphological characteristics of 33 medicinal plants species, and to evaluate their possible use for taxonomic considerations.

Key words: Medicinal plants, Seeds, Morphological observation, Shape, Color.

INTRODUCTION

Medicinal plants have undoubtedly been considered by human beings since ancient times. It can be said that before the history and since the early humans recognized and exploited the plants around them for use as fuel, clothing, shelter and food; they became aware of their properties more or less. Medicinal plants have been transformed into one of the oldest sciences in countries.[1] Identifying medicinal plants and using them is so imperative. Use of medicinal plants is essential for people's health and protects the environment throughout the world. Undoubtedly, identifying is the first step to consume medicinal plants and one way to protect the perceived loss of cultural heritage is to document it.[2] Knowledge regarding the plant types and discussion over their recognition and preservation are the most important fundamentals in field, and they should be handed down to the next generations.[3]

Although medicinal plants play an important role in the drug industry and health care, and attract much attention, few studies have been conducted on their

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seed identification.[4] knowledge of seed morphology is important in theoretical botany and could be useful for seed identification for seed testing, seed quarantine, forensic work, seed dispersal and soil seed bank studies, and for identification of macrofossils in archaeobotanical studies.[5] Seed morphology is a genetic trait, although environmental factors may exert some effect.

Exomorphic features of seeds, in addition to vegetative and reproductive characters, have long been employed as important tools in various scientific studies. However most of the light microscopic feature used are concerned with general shape and size rather than details of surface ornamentation. Seed morphology has been shown to provide useful characteristics for the analysis of taxonomic relationships in a wide variety of plant families.[6]

Plants are identified based on leaves, flowers, bark, seed, fruits, roots, stem and other parameters like height, region of its growth and environmental factors. For identification of plants many authors consider only leaves of the plants, because leaves are of two dimensional natures and are available at all the time.[7] But less research is done in identification of medicinal plants using flower and fruits/seeds because they are three-dimensional in nature and available only in specific seasons.[8]

Seed morphological is now becoming a popular tool for taxonomic identification as it serves as a measure of authenticity and genuinity for production of high quality plants especially for medicinal and aromatic plants for optimum production of secondary metabolites.[9] Seeds of such plants are often used and transported with no collateral plant parts to aid in their identification, so it is particularly important to obtain better knowledge of their morphological characteristics, which could help in determination of species. The purpose of this study was to describe and identify external seed morphological characteristics of thirty-three species of medicinal plants, and to evaluate their possible use for taxonomic considerations.

MATERIALS AND METHODS

Plant Material

The dry cleaned physiologically mature seeds of various medicinal species were taken from traditional medical practitioners, herbalist, hawkers in traditional medicines and rural dwellers in the region of Setifian high plateau which situated in the north east of Algeria between the two longitude 5° and 6° and between the two latitudes 35°. 40 and 36°.35. We put the seed in paper bags to keep it dry and to avoid humidity and climatic factors which lead to germinating these seeds; they were kept in normal condition of laboratory.

Seed morphology

The initial morphological description of the seeds was done using seed size, seed color and shape. The seed dimensions were taken using Digital Caliper (0-150 mm range) of Fisher Scientific make. The dimensions were taken at the point of maximum length/width/thickness in five replicates of randomly selected seeds and average of same is reported in results while seed color is based on visual examination. Surface pattern or spermoderm pattern of the seeds were studied at 40 x magnification using hand held Digital Microscope (LER 4416) and digital photographs were taken. Statistically mean values with standard deviations of each species was computed using the SPSS Software package 2003 version-13.0.

RESULTS AND DISCUSSION

The present study includes seeds of thirty-three species of medicinal plants belonging to sixteen botanical families (Apiaceae, Poaceae, Fabaceae, Brassicaceae, Liliaceae, Plantaginaceae, Cyperaceae, Runnunculaceae, Pedaliaceae, Zygophyllaceae, Pinaceae, Cupressaceae, Portulacaceae, Linaceae, Anacardiaceae, Lamiaceae. Based on light microscopy observation, the examined medicinal plants species showed variation in qualitative and quantitative seed characteristics. The identifying characters described and used in this publication are found only on the external surface of the seeds. Their usefulness for identification varies. Seeds of medicinal plants species included in this study are represented in photos (Figure 1).

Medicinal plants seeds are very variable in size (Tables 1, 2). Seeds length of the species ranged between 0.75±0.11mm and 12.62±0.48 mm, the largest seed were observed in *Cuperus rotundus* L. and the smallest in *Portulaca oleracea* L.

The texture of seeds surface varied between pitted, smooth, glabrous, reticulate and rough (Table 2). An opened reticulate surface was observed in *Cuminum cyminum* L. (Figure 1), smooth seed surface texture in *Zea mays* L., *Petroselinum crispum* (Mill), *Eleusine coracana* (L.), *Lupinus albus* L., *Lens culinaris* Medik., *Glycine max* (L.) Merr., *Raphanus sativus* L., *Brassica nigra* (L.) W.D.J. Koch., *Sinapis alba* L., *Lepidium sativum* L., *Cupressus sempervirens* L., *Portulaca oleracea* L. And *Linum usitatissimum* L. (Table 2), pitted surface in *Coriandrum sativum* L., *Allium cepa* L. and *Nigella sativa* L.

The shape of seeds is showed a large variation among the investigated species. Most of seeds have elongated

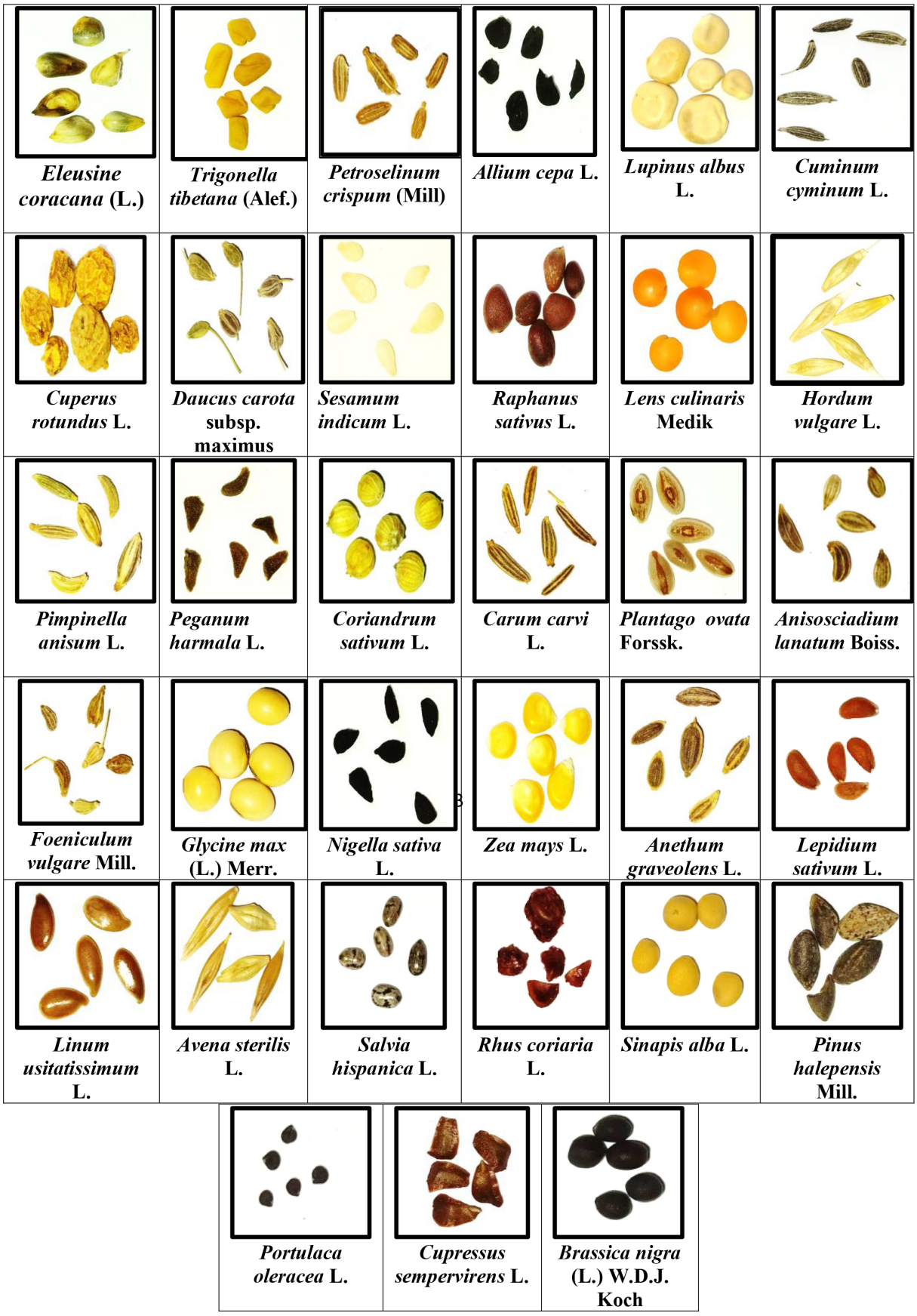

Figure 1: Photos of seeds of medicinal plants species studied

Table 1: Quantitative seed characters of *plants medicinal* species (means ± standard error).

Family	Species	Seed length (mm)	Seed width (mm)	Weight of 100 seeds (mg)
Apiaceae	*Cuminum cyminum* L.	04.37±0.63	01.15±0.18	297.25±04.32
	Anethum graveolens L.	4.52±0.41	1.52±0.49	296±3.94
	Foeniculum vulgare Mill.	3.07±0.50	1.42±0.31	363±41.46
	Daucus carota subsp. maximus	3.67±0.33	1.27±0.18	301±2.16
	Carum carvi L.	5.27±0.38	0.87±0.23	500±70.71
	Pimpinella anisum L.	5.92±0.52	1.92±0.11	812±54.49
	Anisosciadium lanatum Boiss.	3.30±0.79	1.55±0.35	312±21.65
	Coriandrum sativum L.	3.75±0.93	3.75±0.93	1500±70.71
	Petroselinum crispum (Mill)	2.07±0.11	1.02±0.13	316±21.61
Poaceae	*Zea mays* L.	08.90±0.27	05.70±0.32	1525.20±36.20
	Eleusine coracana (L.)	02.77±0.26	01.30±0.16	107.25±9.15
	Hordum vulgare L.	9.87±0.08	2.75±0.18	3.76±0.09
	Avena sterilis L.	12.12±0.65	2.95±0.11	3.32±0.04
Fabaceae	*Trigonella tibetana* (Alef.)	03.37±0.78	02.40±0.31	120.25±07.08
	Lupinus albus L.	07.50±1.20	07.12±1.14	3017.75±119.29
	Lens culinaris Medik	4.64±0.52	4.64±0.52	3.35±0.18
	Glycine max (L.) Merr.	5.52±2.06	5.52±2.06	14.87±0.28
Brassicaceae	*Raphanus sativus* L.	02.40±0.27	01.52±0.29	894.25±8.87
	Brassica nigra (L.) W.D.J. Koch	2.4±0.45	2.4±0.45	0.91±0.01
	Sinapis alba L.	2.07±0.15	2.07±0.15	0.97±0.08
	Lepidium sativum L.	2.6 ±0.38	1.05±0.11	0.68±0.04
Liliaceae	*Allium cepa* L.	02.35±0.21	01.27±0.15	272.75±42.22
Plantaginaceae	*Plantago ovata* Forssk.	01.35±0.11	01.02±0.13	99.75±1.09
Cyperaceae	*Cuperus rotundus* L.	12.62±0.48	08.60±0.50	3982.5±189.92
Rununculaceae	*Nigella sativa* L.	02.17±0.08	00.92±0.11	268.5±39.61
Pedaliaceae	*Sesamum indicum* L.	03.25±0.29	01.07±0.11	296.25±4.02
Zygophyllaceae	*Peganum harmala* L.	03.12±0.04	00.97±0.08	389.75±8.13
Pinaceae	*Pinus halepensis* Mill.	5.55±0.51	3.87±0.15	2.75±0.05
Cupressaceae	*Cupressus sempervirens* L.	4.92±0.08	3.02±0.13	0.97±0.08
Portulacaceae	*Portulaca oleracea* L.	0.75±0.11	0.75±0.11	0.59±0.04
Linaceae	*Linum usitatissimum* L.	4.35±0.5	1.95±0.11	1.15±0.05
Anacardiaceae	*Rhus coriaria* L.	3.65±0.21	1.95±0.11	0.67±0.04
Lamiaceae	*Salvia hispanica* L.	1.27±0.08	0.85±0.11	0.71±0.01

ovoid shape (*Anethum graveolens* L., *Foeniculum vulgare* Mill., *Anisosciadium lanatum* Boiss., *Eleusine coracana* (L.), *Lepidium sativum* L., *Plantago ovata* Forssk, *Cuperus rotundus* L. *Sesamum indicum* L. *Peganum harmala* L. *Pinus halepensis* Mill., *Cupressus sempervirens* L. and *Linum usitatissimum* L.) and others are round (*Lens culinaris* Medik., *Glycine max* (L.) Merr., *Brassica nigra* (L.) W.D.J. Koch. *Sinapis alba* L. and *Portulaca oleracea* L.) or linear in shape(*Cuminum cyminum* L., *Anethum graveolens* L., *Carum carvi* L., *Pimpinella anisum* L., *Hordum vulgare* L.and *Avena sterilis* L.) (Table2). The color of seeds is of high diagnostic and systematic interest among species. The color varies from yellow to brown, brown to dark brown, Light creamy, White, orang, Grayish, Black dark and reddish. The seeds color is yellow to brown in *Foeniculum vulgare* Mill., *Carum carvi* L., *Hordum vulgare* L., *Avena sterilis* L., *Trigonella tibetana* (Alef.) and *Sinapis alba* L. and brown to dark brown in *Cuminum cyminum* L. *Daucus carota* subsp. maximus, *Petroselinum crispum* (Mill), *Raphanus sativus* L., *Lepidium sativum* L., *Plantago ovata* Forssk., *Cuperus rotundus* L., *Peganum harmala* L., *Cupressus sempervirens* L. and *Linum usitatissimum* L. In *Coriandrum sativum* L., *Lupinus albus* L. and *Glycine max* (L.) Merr. seeds are Light creamy. Seeds of *Lens culinaris* Medik are orange while seeds of *Sesamum indicum* L. and *Salvia hispanica* L. are white. Reddish color found only in *Rhus coriaria* L. Seeds of

Table 2: Distribution of characters and their states in seeds of plants medicinal species.

		Morphological characters						
Family	**Species**	**Color**	**Shape**	**Length (mm)**	**Width (mm)**	**Surface**	**Solidity**	**weight (mg)**
Apiaceae	*Cuminum cyminum* L.	2	4	4	1	3	2	4
	Anethum graveolens L.	6	3	4	2	4	1	4
	Foeniculum vulgare Mill.	1	3	3	1	4	2	4
	Daucus carota subsp. maximus	2	5	3	1	4	2	4
	Carum carvi L.	1	4	5	1	4	2	4
	Pimpinella anisum L.	6	4	5	2	4	2	4
	Anisosciadium lanatum Boiss.	6	3	3	2	4	1	4
	Coriandrum sativum L.	3	2	3	3	1	1	4
	Petroselinum crispum (Mill)	2	5	2	1	2	1	4
Poaceae	*Zea mays* L.	3	2	5	3	2	1	4
	Eleusine coracana (L.)	6	3	2	1	2	1	4
	Hordum vulgare L.	1	4	5	2	4	1	1
	Avena sterilis L.	1	4	5	2	4	2	1
Fabaceae	*Trigonella tibetana* (Alef.)	1	2	3	2	2	1	4
	Lupinus albus L.	3	2	5	4	2	1	4
	Lens culinaris Medik	5	1	4	3	2	1	1
	Glycine max (L.) Merr.	3	1	5	3	2	1	2
Brassicaceae	*Raphanus sativus* L.	2	2	2	2	2	1	4
	Brassica nigra (L.) W.D.J. Koch	7	1	2	2	2	1	1
	Sinapis alba L.	1	1	2	2	2	2	1
	Lepidium sativum L.	2	3	2	1	2	2	1
Liliaceae	*Allium cepa* L.	7	5	2	1	1	1	4
Plantaginaceae	*Plantago ovata* Forssk.	2	3	1	1	2	1	3
Cyperaceae	*Cuperus rotundus* L.	2	3	5	4	3	1	4
Rununculaceae	*Nigella sativa* L.	7	2	2	1	1	1	4
Pedaliaceae	*Sesamum indicum* L.	4	3	3	1	2	2	4
Zygophyllaceae	*Peganum harmala* L.	2	3	3	1	4	1	4
Pinaceae	*Pinus halepensis* Mill.	7	3	5	3	4	2	1
Cupressaceae	*Cupressus sempervirens* L.	2	3	4	2	2	2	1
Portulacaceae	*Portulaca oleracea* L.	7	1	1	1	2	2	1
Linaceae	*Linum usitatissimum* L.	2	3	4	2	2	2	1
Anacardiaceae	*Rhus coriaria* L.	8	2	3	2	4	2	1
Lamiaceae	*Salvia hispanica* L.	4	2	1	1	2	2	1

Brassica nigra (L.) W.D.J. Koch, *Allium cepa* L., *Nigella sativa* L., *Pinus halepensis* Mill. and *Portulaca oleracea* L. are Black dark. The seed color is diagnostic at the generic and specific level for some extent.

Table 2 showed that seeds of medicinal plants are fragile in the most of species such as *Pinus halepensis* Mill., *Cupressus sempervirens* L., *Portulaca oleracea* L., *Linum usitatissimum* L., *Rhus coriaria* L. And *Salvia hispanica* L. Average weight of 100 seeds of species was taken, results are given in Table1. Highest weight was observed with seeds of *Zea mays* L. (1525.20±36.20 mg), while lowest weight was found in seeds of *Portulaca oleracea* L. (0.59±0.04 mg).

Length: (1) 0.75–2.07mm, (2) 2.08–3.07mm, (3) 3.08–4.35mm, (4) 4.36–5.27mm, (5) >5.28mm. Width: (1) 0.75–1.52mm, (2) 1.53–3.75mm, (3) 3.76–7.12mm, (4) >7.13 mm. Weight of 100 seeds: (1) 0.50–10.50mg, (2) 10.51–50.50mg, (3) 50.51–100.50mg, (4) > 100.51mg.

Color: (1) yellow to brown, (2) brown to dark brown, (3) Light creamy, (4) White, (5) orang, (6) Grayish, (7) Black dark, (8) reddish. Shape: (1) round, (2) ovoid, (3) elongated ovoid, (4) Linear, (5) Reniform. Seed coat surface: (1) pitted, (2) smooth, glabrous (3) reticulate, (4) Rough. Solidity: (1) Rigged, (2) Fragile.

DISCUSSION

The morphology of seed coat is usually stable and is little influenced by external environmental conditions while the seeds developed and ripen within the fruit.[10,11] Therefore seed characters can provide useful data in the delimitation and identification of species. The morphologic features of different seed structures provide a wide range of characters which can play an important role on the identification oftaxa.[12,13, 14] Micromorphology and ultra-structural data have contributed useful information for evolution and classification of seed plants and play an important role in the modern synthetic systems of medicinal plants.[15,16] As the previous studies on other species of medicinal plants family have shown the morphological characteristics are genetically determined and are the main source of intra- or interspecific variation.[17,18]

Variation in medicinal plants seed morphology was manifested mainly in seed size, shape, hilum location, as well as seed coat ornamentation.[19,20] Quantitative characteristics associated with seed size contributed most to the total variation. The seed coat patterns were more variable, and six different patterns were distinguished. The seed coat pattern together with seed coat morphological and micromorphological characteristics permitted easy identification of seeds. The seeds of medicinal plants species showed great variation in shape. The seed shape as observed in the present study seems to be diagnostic at the generic level. The data of seed shape is compatible with that mentioned before.[15, 21, 22]

This study on medicinal plants seeds showed diversity in shape, dimensions, seed coat surface and color. This type of study with more species may help to add new information to the knowledge about interspecific relationships in this species.[8,11, 23] Both seed color and seed size were importantto separating species (Table 2). Variations in the seed coat patterns at high magnification were generally species-specific. In other words, seed morphological characteristics was helpful in distinguishing various species (Figure 1). The results can be used to reveal taxonomic relationships between species. However, based on the present results, the examined characteristics do not provide sufficient information that could be used to distinguish sections of this species. Seed features do not support the infrageneric classification.

CONCLUSION

Previous studies on seed morphology indicate that seed characters are important for the taxonomy of the species of medicinal plants. Our study also confirms their importance; it shows that seed features, such as ornamentations of the seed surface, seed shape and color, are useful characters for identification of species. The examined seeds are variable in both shape and size. The largest seeds in *Cuperus rotundus* L. have a length of 12.62±0.48 mm, and the smallest seeds measure 0.75±0.11mm in *Portulaca oleracea* L. Most of seeds have elongated ovoid shape (*Linum usitatissimum* L., *Cupressus sempervirens* L., *Pinus halepensis* Mill., *Lepidium sativum* L.…..) and others are Linear (*Hordum vulgare* L., *Avena sterilis* L.…) or ovoid (*Rhus coriaria* L., *Salvia hispanica* L..). Seeds color varies from yellow to brown, brown to dark brown, light creamy, white, orang, grayish, black dark and reddish. Highest weight was observed with seeds of *Zea mays* L. (1525.20±36.20 mg), while lowest weight was found in seeds of *Portulaca oleracea* L. (0.59±0.04 mg).

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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