

## Morphological characteristics of plants medicinal seeds of some species belonging to Apiaceae family in the region of Sétif, Algeria

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### Abstract

The seed morphology of eight species of plants medicinal belonging to Apiaceae family is presented. As a result of the study, the shape of seeds is showed a large variation among the investigated species. Most of seeds have oval to oblong shape (*Anethum graveolens* L., *Foeniculum vulgare* Mill., *Daucus carota* subsp. Maximus, *Anisosciadium lanatum* Boiss.) and others are linear (*Carum carvi* L., *Pimpinella anisum* L.), spherical (*Coriandrum sativum* L.) or reniform in shape (*Petroselinum crispum* (Mill)). The color varies from grayish-green to grayish-brown, yellow-brown, light brown, greenish-yellow, greenish-brown reddish- brown, greenish-brown, yellow to orangy- or reddish- brown, grayish-green to grayish-yellow, grayish-green, light creamy yellow to yellow, brown, yellow dark to brown. Seeds dimensions vary greatly among the examined species. Seed morphological characteristics proved to be useful taxonomic features, helpful in identification of large number of species and genera.

**M**edicinal plants are already known as a natural source of a range of bioactive compounds. Therefore, the researchers today are emphasizing on evaluation and characterization of various plants and plant constituents against a number of diseases based on their traditional claims<sup>21</sup>. Algeria is characterized by a diverse climate and topography, which are favorable for the development of a flora rich in aromatic and medicinal plants<sup>5</sup>.

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 nature and are available at all the time<sup>17</sup>. 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<sup>15</sup>.

To identify plant seeds and fruits, it is important to know to which family of plants they belong. To further identify them to species, one is able to narrow down the possibilities using both the scientific literature and reference collections. Especially in families with many genera, the morphology of fruits and seeds can vary considerably. This variation is a result of the fact that the grouping of genera into families is not only based on characteristics dealing with generative plant parts. In addition, specific adaptations to seed dispersal mechanisms have occurred within more than one family<sup>6</sup>.

Apiaceae family is one of the most important families of flowering plants, which consists of 3780 species in 434 genera. It is distributed throughout the world, mostly in the northern temperate regions and high altitudes in the tropics. The main common features of Apiaceae species are: aromatic herbaceous nature, alternate leaves with sheathing bases, hollow stems, small flowers, inflorescences determined in simple or compound umbel, and indehiscent fruits or seeds with oil ducts<sup>8</sup>. Apiaceae family provides a large number of plants which are used for different purposes including nutrition, medicine, beverages, spices, repellents, staining, cosmetics, fragrances and industrial uses. Ethnomedically, several plants of this family are used as home based remedies to treat various illnesses related to digestive, endocrine, reproductive and respiratory systems<sup>18</sup>.

Moreover, the seeds of Apiaceae species are identified as promising source of an unusual specific fatty acid; the petroselinic acid (C18:ln 12): its content in Apiaceae

oilseeds is over than 50%; this fatty acid is the only isomer of oleic acid occurring naturally in plants; it has many potential uses as a valuable oleo chemical raw material for industry<sup>4</sup>

Seed structure has been used in the understanding of many natural groups of angiosperms. For example, they are significant for the systematics of the vanilloid orchids<sup>19</sup> and for the tribe Hyoscyameae of the Solanaceae<sup>23</sup>. A wider study on the systematic value of seed surface ornamentation and epidermal tissue in general showed the importance of the shape of individual cells<sup>10</sup>. The cells are only slightly influenced by environmental conditions, and therefore present helpful characters in the understanding of phylogenetic relationships<sup>7</sup>.

Since seed morphology is a heritable trait, the knowledge of seed morphology is an important tool for seed identification for various purposes. The information presented here on various macro-morphological features of seed can serve as a base for the identification of medicinal plant<sup>20</sup>. 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 eight species belonging to Apiaceae, and to evaluate their possible use for taxonomic considerations.

*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.

Table-1. Information on studied species

| Scientific name                            | Local name      | English      | Plant name used  | Medicinal part(s) use                                   | Traditional preparation                  |
|--|-----------------|--------------|------------------|---|--|
| <i>Anethum graveolens</i> L.               | Shebt           | Dill         | Seeds            | Antispasmodic<br>Carminative                            | Seeds are boiled and the stock is drunk. |
| <i>Foeniculum vulgare</i> Mill.            | Habet hlawa     | Fennel       | Leaves and stems | Stomach cramps  | Infusion                                 |
| <i>Daucus carota</i> subsp. <i>maximus</i> | Djazar          | Wild carrot  | Roots and seeds  | Depurative  | Infusion                                 |
| <i>Carum carvi</i> L.                      | Carwiya         | Caraway      | Seeds            | antispasmodic<br>carminative<br>digestive and stimulant | Decoction                                |
| <i>Pimpinella anisum</i> L.                | Zariet elbesbes | Anise        | Seeds            | Carminative<br>Against diarrhea                         | Infusion                                 |
| <i>Anisoscadium lanatum</i> Boiss.         | Yanssoun        | Anisoscadium | Seeds            | Antispasmodic<br>Carminative                            | Decoction                                |
| <i>Coriandrum sativum</i> L.               | Kosbor          | Coriander    | Leaves and seeds | Stomachic,<br>Against diarrhea                          | Decoction                                |
| <i>Petroselinum crispum</i> (Mill)         | Bakdounes       | Parsley      | Leaves           | Laxative  | Decoction                                |

(±SD): Standard deviation

Statistically mean values with standard deviations of each species was computed using the SPSS Software package 2003 version-13.0.

*Morphological characteristics :*

In this study the characteristics like: shape, color, size, solidity, brightness, seed length, seed width, seed diameter, appendages, and weight per 100 seeds for identification were used as suggested by various workers<sup>1,12,13</sup>. In order to identify the different morphological characteristics of seeds species of plants medicinal belonging to Apiaceae family, we

found that the single character is not enough to distinguish the species because the seeds of more than one species possess same mean value however their standard deviations vary. But the consideration of these characteristics collectively was found unique in this study. The identifying characters described and used in this publication are found only on the external surface of the seeds. Their usefulness for identification varies. Characters of major importance are color, size and shape of the seed<sup>14</sup>. Other characters used in conjunction with these features have limited use. Seeds of Apiaceae species included in this study are represented in photos (Photo1 to Photo 08).



Photo 1: Seeds of  
*Anethum graveolens* L.



Photo 2: Seeds of  
*Foeniculum vulgare* Mill.



Photo 3: Seeds of  
*Daucus carota* subsp.  
maximus



Photo 4: Seeds of  
*Carum carvi* L.



Photo 5: Seeds of  
*Pimpinella anisum* L.



Photo 6: Seeds of  
*Anisoscadium lanatum*  
Boiss.



Photo 7: Seeds of  
*Coriandrum sativum* L.



Photo 8: Seeds of  
*Petroselinum crispum* (Mill)

Each species shows morphological characteristics different from the plant or other species, these morphological characteristics are not restricted to the external form of the plant only but it can be on level of different other parts of plant like fruit and seed<sup>20</sup>. However, according to Imbert *et al.*, (1997) the Variation in seed size is an important character for evolutionary plant ecologists. Variation occurs at several biological levels, from differences between species to within-individual variation. Seed heteromorphic is a special case of within-individual variation in seed size involves the production by single individual plants of seeds of different morphology. In several species, differentiation in morphology is accompanied by a difference in seed size<sup>16</sup>.

The shape of seeds is showed a large variation among the investigated species. Most of seeds have oval to oblong shape (*Anethum graveolens* L., *Foeniculum vulgare* Mill., *Daucus carota* subsp. Maximus, *Anisosciadium lanatum* Boiss.) and others are linear (*Carum carvi* L., *Pimpinella anisum* L.), spherical (*Coriandrum sativum* L.) or reniform in shape (*Petroselinum crispum* (Mill)) (Table-2, Table-3). 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 by Gunes<sup>12</sup>. The color of seeds is of high diagnostic and systematic interest among species. The color varies from grayish-green to grayish-brown, yellow-brown, light brown, greenish-yellow, greenish-brown reddish- brown, greenish-brown, yellow to orangy- or reddish- brown, grayish-green to grayish-yellow, grayish-green, light creamy yellow to yellow, brown, yellow dark to brown. The seeds color is yellow-

brown, light brown, greenish-yellow, greenish-brown in *Foeniculum vulgare* Mill. and grayish-green to grayish-brown in *Anethum graveolens* L., *Pimpinella anisum* L. and *Anisosciadium lanatum* Boiss. In *Daucus carota* subsp. maximus and *Carum carvi* L. seeds color greatly varies in same specie between Reddish- brown, greenish-brown and yellow to orangy- or reddish- brown. The seed color is diagnostic at the generic and specific level for some extent. The data of seed color is compatible with that mentioned before by Cappers and Bekker<sup>6</sup>.

Seeds dimensions vary greatly among the examined species, the largest seeds in *Lathyrus ochrus* L. have a length of  $5.92 \pm 0.52$  mm and width of  $1.92 \pm 0.11$  mm and the smallest seeds measure  $02.07 \pm 0.11$  mm  $1.02 \pm 0.13$  mm in *Petroselinum crispum* (Mill), while the rest of the studied species have seeds their dimensions from  $3.07 \pm 0.50$  mm,  $1.42 \pm 0.31$  mm to  $5.27 \pm 0.38$  mm,  $0.87 \pm 0.23$  mm. The seed size was found useful to separate species of *Anethum graveolens* L. and *Anisosciadium lanatum* Boiss. from the other species (see Tables-2 and 3).

The character of Seeds surface texture can be of considerable diagnostic and systematic value. The surface shape is rough in the most of species as *Daucus carota* subsp. Maximus, *Anisosciadium lanatum* Boiss., *Anethum graveolens* L., *Foeniculum vulgare* Mill., *Carum carvi* L., *Pimpinella anisum* L., *Coriandrum sativum* L. *Petroselinum crispum* (Mill). This is in accordance with the work of Sandeep<sup>17</sup>.

Table-2. Morphological characteristics of species seeds (*Anethum graveolens* L., *Foeniculum vulgare* Mill., *Daucus carota* subsp. Maximus, *Carum carvi* L.)

| Name of species           |   |  |                                     |   |
|---------------------------|---|--|-------------------------------------|---|
| Morphological characters  | <i>Anethum graveolens</i> L.            | <i>Foeniculum vulgare</i> Mill.                            | <i>Daucus carota</i> subsp. maximus | <i>Carum carvi</i> L.                   |
| Seed color                | grayish-green to grayish-brown          | yellow-brown, light brown, greenish-yellow, greenish-brown | Reddish- brown, greenish-brown      | yellow to orangy- or reddish- brown     |
| Seed shape                | Oval to oblong                          | oblong to obovate  | Oval to oblong, Reniform            | Linear                                  |
| Seed size (mm)            | 4.52±0.41 mm<br>1.52±0.49 mm            | 3.07±0.50 mm<br>1.42±0.31 mm                               | 3.67±0.33 mm<br>1.27±0.18 mm        | 5.27±0.38 mm<br>0.87±0.23 mm            |
| Seed surface              | Rough, reticulation lines wide and flat | Rough, distinctly reticulated                              | Rough, distinctly reticulated       | Rough, reticulation lines wide and flat |
| Seed solidity             | Rigged                                  | Fragile  | Fragile                             | Fragile                                 |
| Seed brightness           | Pale                                    | Pale   | Bright                              | Bright                                  |
| Appendages                | short beak                              | short beak   | None                                | None                                    |
| Weight per 100 seeds (mg) | 296±3.94                                | 363±41.46  | 301±2.16                            | 500±70.71                               |

(±SD): Standard deviation

Table-3. Morphological characteristics of seeds of *Pimpinella anisum* L., *Anisosciadium lanatum* Boiss., *Coriandrum sativum* L., and, *Petroselinum crispum* Mill)

| Name of species           |                                 |   |  |   |
|---------------------------|---------------------------------|---|--|---|
| Morphological characters  | <i>Pimpinella anisum</i> L.     | <i>Anisosciadium lanatum</i> Boiss.     | <i>Coriandrum sativum</i> L.   | <i>Petroselinum crispum</i> (Mill)      |
| Seed color                | grayish-green to grayish-yellow | grayish-green                           | Light creamy yellow to yellow, brown                                       | Yellow dark to brown                    |
| Seed shape                | Linear                          | Oval to oblong                          | Spherical  | Reniform                                |
| Seed size (mm)            | 5.92±0.52 mm<br>1.92±0.11 mm    | 3.30±0.79 mm<br>1.55±0.35 mm            | Diameter<br>3.75±0.93 mm   | 2.07±0.11 mm<br>1.02±0.13 mm            |
| Seed surface              | Rough, distinctly reticulated   | faintly reticulated or faintly granular | Rough, covered with distinct concentric ridges or loops like a fingerprint | Rough, reticulation lines wide and flat |
| Seed solidity             | Fragile                         | Rigged                                  | Rigged   | Rigged                                  |
| Seed brightness           | Bright                          | Pale                                    | Pale   | Pale                                    |
| Appendages                | short beak                      | None                                    | None   | short beak                              |
| Weight per 100 seeds (mg) | 812±54.49                       | 312±21.65                               | 1500±70.71   | 316±21.61                               |

(±SD): Standard deviation

Table-3 showed that seeds of Apiaceae are rigged in some species such as *Anethum graveolens* L., *Anisosciadium lanatum* Boiss., *Coriandrum sativum* L., and *Petroselinum crispum* (Mill). While in *Foeniculum vulgare* Mill., *Daucus carota* subsp. Maximus, *Carum carvi* L., and *Pimpinella anisum* L. seeds are fragile. Seeds vary between bright in *Pimpinella anisum* L., *Daucus carota* subsp. maximus and *Carum carvi* L. and Pale in *Anethum graveolens* L., *Foeniculum vulgare* Mill., *Anisosciadium lanatum* Boiss., *Coriandrum sativum* L. and *Petroselinum crispum* (Mill). Seeds can have a short beak in *Anethum graveolens* L., *Foeniculum vulgare* Mill., *Pimpinella anisum* L. and *Petroselinum crispum* (Mill). Average weight of 100 seeds of species was taken, results are given in tables 2 and 3. Highest weight was observed with seeds of *Coriandrum sativum* L. (1500± 70.71 mg ), while lowest weight was found in seeds of *Petroselinum crispum* (Mill) (296±3.94 mg).

Seed characters are very important to separate among species in the Apiaceae family. Previous studies on seed morphology indicate that seed characters are important for the taxonomy of the species. 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 of Apiaceae. The examined seeds are variable in both shape and size. The size of the smallest seed is about 2 mm in length (*Petroselinum crispum* (Mill)) and the size of the largest seed is about 6 mm in length (*Pimpinella anisum* L.). Most of the examined seeds are Oval to oblong (*Anethum graveolens* L., *Foeniculum vulgare* Mill., *Daucus carota* subsp.

Maximus, *Anisosciadium lanatum* Boiss.). The seed colors also vary among the examined species, from yellow-brown, light brown, greenish-yellow, greenish-brown in *Foeniculum vulgare* Mill. and grayish-green to grayish-brown in *Anethum graveolens* L., *Pimpinella anisum* L. and *Anisosciadium lanatum* Boiss. In *Daucus carota* subsp. maximus and *Carum carvi* L. seeds color greatly varies in same specie between Reddish- brown, greenish-brown and yellow to orangey- or reddish-brown .The purpose of this study was to describe and identify external seed morphological characteristics of eight species belonging to Apiaceae, and to evaluate their possible use for taxonomic considerations.

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