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MORPHOLOGICAL AND PALYNOLOGICAL INVESTIGATIONS ON SOME TAXA OF *MEDICAGO* L. (FABACEAE) GENUS DISTRIBUTING IN ŞANLIURFA

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ABSTRACT

In this study, the morphological and palynological features of *Medicago noeana* Boiss. *Medicago coronata* (L) Bart., *Medicago minima* (L) Bart., species belonging to *Medicago* genus of Fabaceae family distributed in Şanlıurfa province were studied. Within the framework of morphological studies, the field was explored and herbarium samples were examined. Morphological measurements were compared with 'Flora of Turkey'. In the framework of the palynological study, pollen shapes, ornamentations, porus and colpus lengths and widths were examined.

Introduction

The Leguminosae family (Fabaceae) is the third largest family of flowering plants than Orchidaceae ve Asteraceae. There are approximately 19,325 species belonging to 727 genera in this family (Lewis, Schrire, Mackinder, & Lock, 2005). In Turkey, it contains about 1013 species belonging to 71 genera and is the second largest family in terms of species number. 400 of these species are endemic and the rate of endemism in Fabaceae family is 39% (Ceter, Ekici, Pinar, & Ozbek, 2013; Davis & Tan, 1988; Erik & Tarıkahya, 2004; İşgör, Alan, Aşcı, Çeter, Duran, & Pınar, 2012; Karaman, Aytaç, Ekici, Önde, & Çeter, 2014; Metin, Çeter, &

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Erkul, 2018; Pinar, Akan, Ceter, Aytac, Ekici, Acar, et al., 2014).

Medicago genus with annual and perennial species which is an important of legumes (Fabaceae) family with its striking colorful flowers, has 87 species (Gholami, De Geyter, Pollier, Goormachtig, & Goossens, 2014; Small, 2010). The gene center of the *Medicago* genus, commonly known as clover, is the Mediterranean basin and southwestern Asian region. Few pollen studies have been conducted on *Medicago* species (Ciappini, Vitelleschi, & Calviño, 2016; Forcone & Tellería, 1998; Khan, Akhtar, & Khan, 2020; Wali & Akhtar, 2017).

Pollens have a distinctive feature specific to that species, which varies in each plant. Because of this feature, its contribution to the systematic undeniable. It can help to identify and classify plants in species, genus and higher systematic categories. Therefore, a palynological study was conducted on some species of *Medicago* genus grown in Şanlıurfa. Pollens belonging to the species were examined under light microscope and scanning electron microscope and pollen morphology were determined.

Materials and methods

Table 1 Localities the samples were collected

Taxon	Locality	Flowering
M. noeana	C7 Şanlıurfa-Bozova road: Tektaş village junction, field edge, 720 m, 13.05.2006, MNM. 1071; Şanlıurfa-Bozova road: Keskintaş village, field edge, 710 m., 13.05.2006 MNM, 1139.	April, May
M. coronate	C7 Şanlıurfa-Viranşehir highway 45. km, step-rocky, 665 m, 13.05.2007, MNM and MM. Balos.1258	April, May
M. minima	C7 Şanlıurfa - Kalecik Mountain: Kalecik hamlet surroundings, stony areas 900 m., 23.05.2002, M.A. 1105; Şanlıurfa, east of Kırkpınar village, 850 m., stony areas 25.03.2003, M.A. 1169.	April, May

Medicago noeana, *M. coronata*, *M. minima*, species belonging to *Medicago* genus distributed in Şanlıurfa constitute the study material. The plants in the study were taken from the herbarium of Harran University, Faculty of Arts and Sciences, Department of Biology (HARRAN) (Table1).

Morphological Method

After determining the general characteristics of the species, flowering pollen formation time, habitat and distribution map of each species were created. The dried photographs of the species to be investigated in terms of morphology were taken in the herbarium and both the height of the plant and the length of the leaves were measured with a ruler. In addition, morphological features were noted by conducting field studies in different periods.

Palynological Method

Light Microscope Method

Pollen preparations of the pollen taken from the flower anthers of the samples turned into herbarium material were prepared according to the Wodehouse method (1935), stained with basic fuchsine and examined under the light microscope (Wodehouse, 1935).

Scanning electron microscope (SEM) method

Pollen samples were placed on aluminum staples with the help of double-sided adhesive tape, covered with gold with the Essington Sputter Coater device, and their microphotographs were taken with the Quanta FEG 250 model Scanning Electron Microscope (SEM). Pollen surface morphology and ornamentation analysis of taxa were made using SEM microphotographs and related literature (Aytuğ, 1967; Erdtman, 1969; Iversen, 1950; Kılıç, Dağdeviren, Caner, & Akkemik, 2020; Punt, Hoen, Blackmore,

Nilsson, & Le Thomas, 2007).

Research Findings

Morphological Findings

Medicago noeana

It's Turkish name is Cevrince. It is an annual herbaceous plant that is not endemic. The height of the plant is 18-32 cm. Its fruit is spiny, cylindrical, helical and 3-6 mm. Its fruit is around 3 cm. Flowering period is April and May. It starts at 400 meters and spreads up to 1000 meters. Heavily calcareous soils are also common at the edge of the field and in the ruins. It grows in Aegean, Central Anatolia and Southeastern Anatolia regions.

Medicago coronata

Medicago coronata colloquially or Turkish name is loose clover. It is an annual herbaceous plant that is not endemic. The height of the plant is 11-29 cm, the fruit is around 2-5 mm, with spines and hairless. The leaflet is 4-6 mm. The flowering period is March-April and May. It grows on rocky limestone slopes, steppe, rocky and stony plains. It is seen that it starts from sea level and grew up to 1000 meters. It spreads in the Marmara Region, Mediterranean and southeast Anatolia regions.

Medicago minima

Medicago minima is colloquially known as gurnik in Turkish. It is an annual herbaceous plant that is not endemic. It grows on steppe stony slopes, river banks, roadsides, rocky limestone slopes, fields. It starts from sea level and spreads up to 1750 meters. It is seen in almost every region of Turkey.

Palynological Findings

Medicago noeana

Pollens are radially symmetrical, isopolar, trizonocolporate. Pollen shape is Prolate-spheroidal (P/E; 1.039 µm), polar axis 35.08-39.83 µm, equatorial diameter 34.33-38.25 µm.

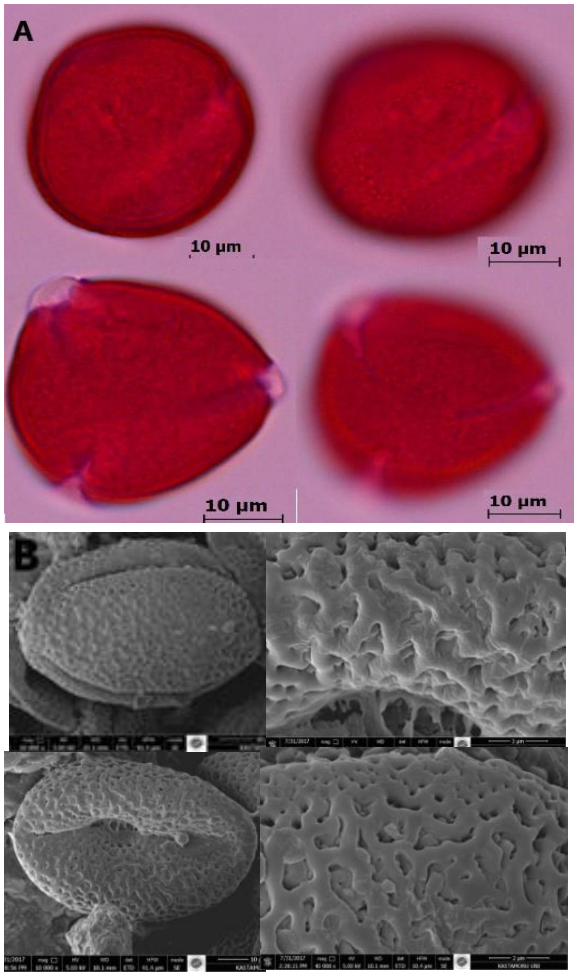

Figure 1 A. Pollen morphology of *M. noeana* examined by light microscope (LM), **B.** Pollen morphology of *M. noeana* examined by scanning electron microscope (SEM).

Amb shape is semi-triangular, with apocolpium 13.42 µm and mesocolpium 28.46 µm. The ornamentation was detected as micro-reticulate-perforate reticulate in the

equatorial region around the aperture and in the polar region. The corpus is thin, long and operculate, the membrane of the operculum has granulate ornamentation (Table 2).

Medicago coronata

Pollens are radially symmetrical, isopolar, trizonocolporate. Pollen shape is Prolat-spheroidal (P/ E; 1.11 µm .), polar axis 27.75-32.75 µm, Equatorial diameter 25.58-30.16 µm. Amb shape is semi-triangular, apocolpium diameter is 11.27 µm and mesocolpium is 20.66 µm. The Ornamentation is psilate-perforate around the aperture and polar region, and microreticulate in the equatorial region.

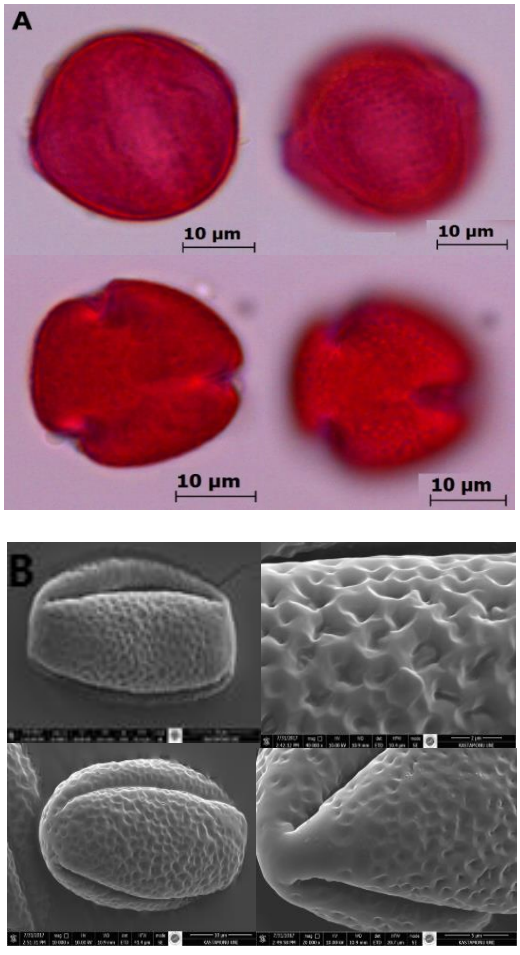

Figure 2 A. Pollen morphology of *M. coronata* examined by light microscope (LM), **B**. Pollen morphology of *M. coronata* examined by scanning electron microscope (SEM)

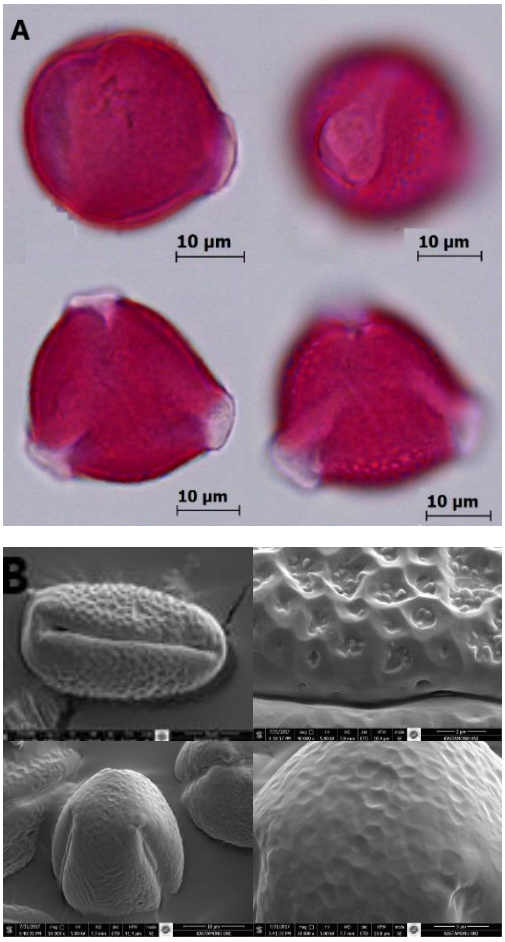

Figure 3 A. Pollen morphology of *M. minima* examined by light microscope (LM), **B.** Pollen morphology of *M. minima* examined by scanning electron microscope (SEM).

The colpus is thin, long (Clg 22.25-26.41 µm, Clt 3.83-5.16 µm) and operculate. The membrane of the operculum is the psilate. The Porus elongated and its shape (Plg 6.75-10.58 µm, Plt 9.83-15.75 µm) was sub-oblate (Table 2).

Medicago minima

Pollens are radially symmetrical, isopolar, trizonocolporate. Pollen shape is Prolate-spheroidal, polar axis is 27.75-31.08 µm, and equatorial region is 25.08-31.33 µm. P/E 1.05 µm detected.

Amb shape is semi-triangular, with apocolpium diameter of 13.85 µm and mesocolpium 20.18

µm. The Ornamentation was determined as psilate in the periphery of the aperture and polar region, as reticulate in the equatorial region. The colpus is thin, long (Clg 23.5 µm, Clt 4 µm) and operculate. Operculum membrane has psilate ornamentation. The Porus elongates and its shape (Plg 10.41 µm, Plt 913.5 µm) is sub-oblate (Table 2

Table 2. Pollen characteristics of *Medicago* taxa

Taxon	polar axis (P)			Equatorial diameter E)			P/E ratio and Pollen shape	Aperture type	Ornamentation		Kolpus(Cl)		Por (Pl)		Exine	Intine	Apocolpium	Mezocolpium
	Min.	Ort.	Max.	Min.	Ort.	Max.			polar region and around Apertur	Equatorial region	Clg	Clt	Plg	P				
M. noeana	35.08	36.84	39.83	34.33	35.39	35.66	1.039 / prolat-Spheroidal	Trizonocolporate	Microreticulate-perforate	reticulate	-	-	-	-	0.80	0.51	13.42	28.46
M. coronata	27.75	30.89	32.75	25.58	27.75	30.16	1.11 / / prolat-Spheroidal	Trizonocolporate	Pslat- perforate	microreticulate	24.39	4.7	10.41	12.14	0.69	0.51	11.27	20.66
M. minima	27.75	29.19	31.08	25.08	27.79	31.33	1.05 / prolat-Spheroidal	Trizonocolporate	psilate		23.5	4	10.41	13.5	0.78	0,43	13.85	20.18

*Clg: Colpus width, Plg: Pore width

*Clt: Colpuslength, Plt:Poreleng

Results and Discussion

In this study, *M. noeana, M. minima, M. coronata* species were compared in terms of morphology and palynology, their different aspects were determined and tried to be clarified.

There are many taxonomic errors in the systematic using only morphological characters. Morphological and palynological comparisons of some taxa of *Medicago* genus in Fabaceae family were made.

By obtaining information about the morphological features of *Medicago*, it was tried to complete the deficiencies in this subject. We believe that it will contribute to systematic studies. In our study, field work was carried out and plants in the herbarium of the Şanlıurfa Department of Biology (HARRAN) were also used.

As a result of our morphological studies, it was determined that some of the morphological characters of the examined species were different from those in Flora. While the plant heights of *Medicago* vary between 11-32 cm,

the highest plant height was *M. noeana*. It is in harmony with that of the flora. When the morphological data obtained in our study were examined, it was determined that it showed parallel features with the data in the Flora of Turkey.

In our study, all *Medicago* pollens were radial symmetrical, isopolar and trizonocolporate. Polar axis (P) of *Medicago* is 27.75- 39.83 µm, equatorial axis (E) is 25.08- 35.66 µm. Amb shapes are all semi-triangular, exine 0.69-0.80 µm, intine 0.43- 0.51 µm. In general, the colpus is thin and long, Clg 23.5- 24.39 µm, Clt 4- 4.7 µm. Plg 10.41 µm, Plt 12.14- 13.5 µm. Apocolpium diameter 11.27- 13.85 µm. Pollen shape is prolate-Spheroidal, aperture type is trizonocolporate.

The species with the smallest polar axis is *M. minima*. The largest on the polar axis is *M. noeana*. Its equatorial axis was the smallest *M. minima. M. noeana*, with the largest equatorial axis.

Surface ornamentation features of pollens are also important in the differentiation of taxa. *Medicago* is Microreticulate-perforate, Pslat-perforate and psilate in the equatorial region. It is reticulate-microreticulate in the polar region.

In our study, pollen morphologies of taxa were examined by light microscopy and scanning electron microscopy (SEM). In our literature review, no study was found to determine the pollen morphologies of M. noeana, *M. minima,* and *M. coronata* species.

As a result of our study, the differences of the species, which are difficult to distinguish from each other in terms of morphology, are revealed by looking at their palynological features. In addition, *Medicago* species were examined morphologically and palynologically and supported by figures. This study will shed light on future palynological studies with members of this family and genus.

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