Comparative Study of Stem Anatomy for Some *Poa* L. Species (Poaceae) in Iraq

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Abstract:

Anatomical investigations of sex species of the genus *Poa* L. from the family Poaceae in Iraq which includes (Poa*angustifolia*L., *Poa annua* L., *Poa araratica* Trautv., *Poabulbosa* L., *Poa pratensis* L. *and Poa trivialis*L.)were carried out on the stem (Culm) epidermis and cross section, to clarify the importance and significance of these quantitative and qualitative characters to support the previous evidence of these kinds of studies .Diameter of Culm cross section, sclerenchyma thickness and distribution, number, shape, length of vascular bundles showed differences among species which was a good taxonomic value helped to separate and isolate species of the genus. Size and shape of stomata, specific characters of short and long cells and indumentums are all mentioned tables as well as anatomical photos of the species is presented in this paper.

Keywords: Stem Anatomy, *Poa Genes*, Iraq.

* Part of Ph.D dissertation of the first author

Introduction

Term anatomy refers to the internal structures of plants and considered a separate, distinct field investigated at the cellular level and often involves the sectioning of tissues and microscopy (11).

Several studies on plant anatomy have been done by several botanists, one of those is the Italian doctor and microscopist, Marcello Malpigi was one of the two founders of plant anatomy. In 1671 he published his Anatomia Plantarum, the first major advance in plant physiogamy since Aristotle. Agnes Arber a British botanist made a very important move in plants comparative anatomy when she published Water Plants: A study of aquatic angiosperms in 1920, Monocotyledones: A morphological study in 1925, and the Gramineae: A study of cereal, Bamboo and Grass in 1934. (15).

After 1945, Katherine Esau Published Plant anatomy (1953), which became the definitive textbook on plant structure in North America universities and even here in Iraq (10).

Grasses are of major importance to archaeobotanists and other scholars who investigate the ecology and subsistence of human populations through much of the old world, this group of plants provided a varied and important set of food resources to human – gatherers, therefore the family are pre-eminent on the score of absolute completeness of distribution and excellent subjects for the study of taxonomic history(12). In addition to the wild material for domestication of the world's most productive crop plants and the wide variety of the weeds that infest cultivated fields (1). Poaceae have a nodal vascular plexus, Microhairs variation in the family is extensive and of some use in delimiting major groups (4, 5), the recent study of the some genera of this family is carried out by Alnomani (3) whose mentioned the importance of stem anatomical characters and it may assist in the identification of grasses or may help to distinguish genera (8).

Poa is a genus of about 500 species of grasses native to the temperate regions of both hemispheres. Common names include meadow–grass (mainly Europe and Asia), bluegra ss (mainly North America), tussock (some New Zealand species), and spear grass. "Poa" is Greek for fodder. *Poa* are members of the Pooideae subfamily of the Poaceae family. The genus *Poa* includes both annual and perennial species. Mostare monoecious, but a few are dioeciously. The leaves are narrow, folded or flat, sometimes bristled, and with the basal sheath flattened or sometimes thickened, with a blunt or hooded apex and membranaceous ligules(13).

Depending on the foregoing the aim of this study is to improve and clarify the importance and the variance of stem anatomical characters of the Poaceae.

Materials and Methods

Plant material

The sample of sex species culms*Poa angustifolia, Poa annua, Poa araratica*, *Poabulbosa* , *Poa pratensis and Poa trivialis*were collected from Kurdistan of Iraq which has been identified by corresponding author based on (6,7), and several specimens were loaned from Iraqis herbariums which are :

1- Baghdad University and National Iraqi Herbarium of Abu-Ghraib (BAH).
2- Babylon University Herbarium, College of Science (BLN).

Fresh samples were not available since it's distributed in very far areas, and the collected fresh samples were dried in order to protect it and kept as specimens, therefore this work was applied on dried samples only.

Samples Preparation

Previously collected dried culms was putted in boiling distilled water for 3minutes and then removed and hand sectioned by a razor from the

middle portion the Culm, several prepared sections were removed and stained with safranin (stains prepared by Al-Daaegi methods (2)) for one minute and washed with boiled water again to get rid of the remnants, samples are preserved with glycerin and labeled until examination. The samples were tested by Human light microscope and photographed by Galaxy Samsung Mobile (Note 1) camera.

Results

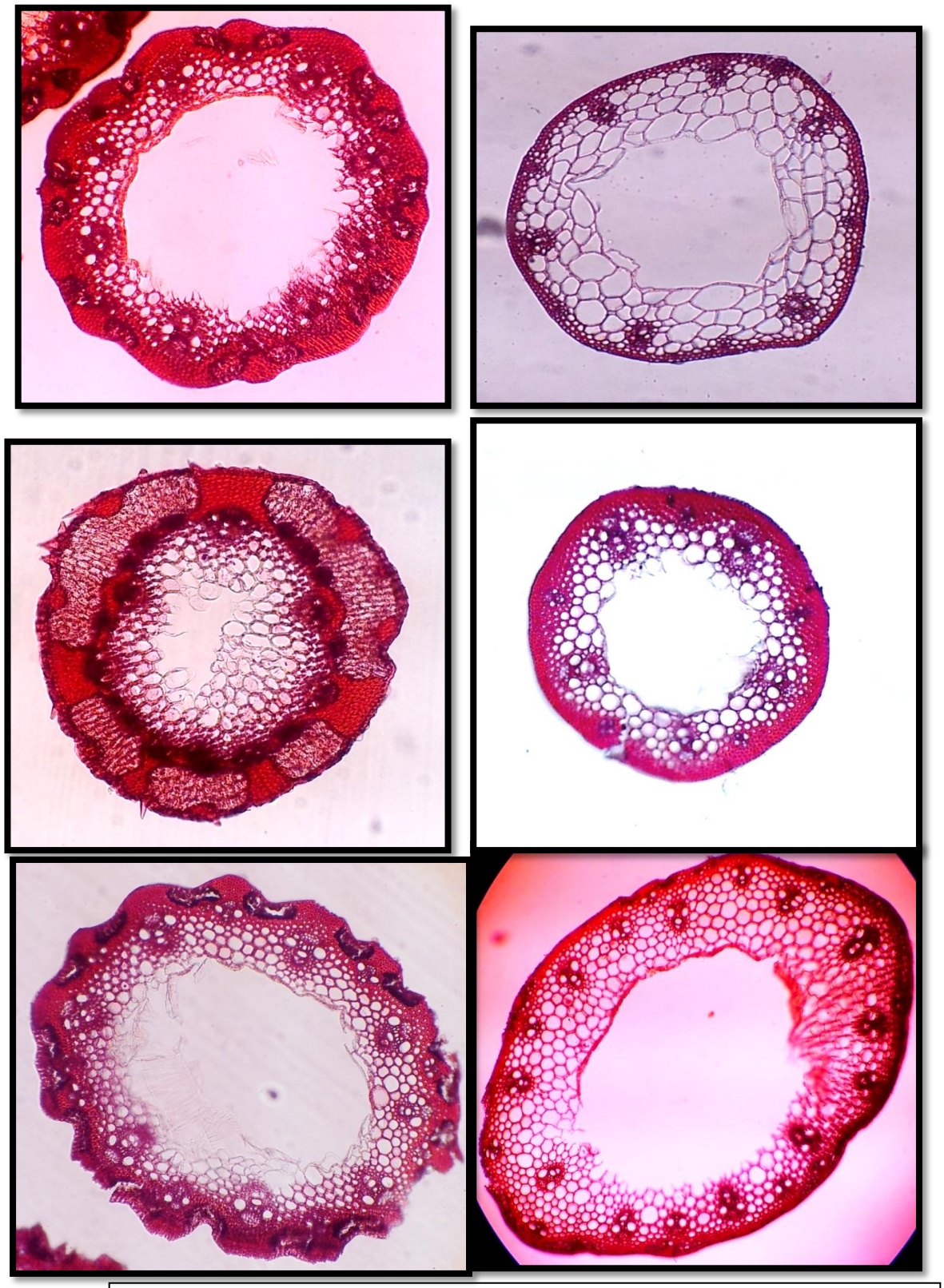
Anatomical study of speciesculms (Epidermis and cross section) showed great taxonomic values (Table 1) for cross sections which view the circular outline, solid in *Poaararatica* and hollow in other species .Culms diameters varied between low values range from (0.39-0.51) mm in *Poapratensis* to high value in *Poatrivialis* (1.69-1.76) mm, while other four species ranging between the two species (figure 1, 2).sclerenchyma layers show different shapes of girders and strands as follows:

1- Continuous sclerenchyma layer extended around all section with peripheral vascular bundle embedded in it such as, *Poa annua*, *Poabulbosa* and *Poatrivialis*.

2- Rectangular and narrow sclerenchyma girder and destroyed parenchyma layer ex: *Poaararatica*.

3- Arched shaped girders in *Poaangustifolia* and *Poapratensis*.

Sclerenchyma rows ranged from (4.5) µm as lowest average in *Poaannua* to highest average (10.3) µm in *Poapratensis*, vascular bundle are close and collateral with elliptical to ovate shape. The length of the major vascular bundles range from (47.5-62.5) µm in *Poaannua* to (105.0 – 122.5) µm in *Poapratensis*, while the width of major bundles varies between (122.5 – 135.0) µm in *Poapratensis* to (47.5-70.0) µm in *Poaannua*.

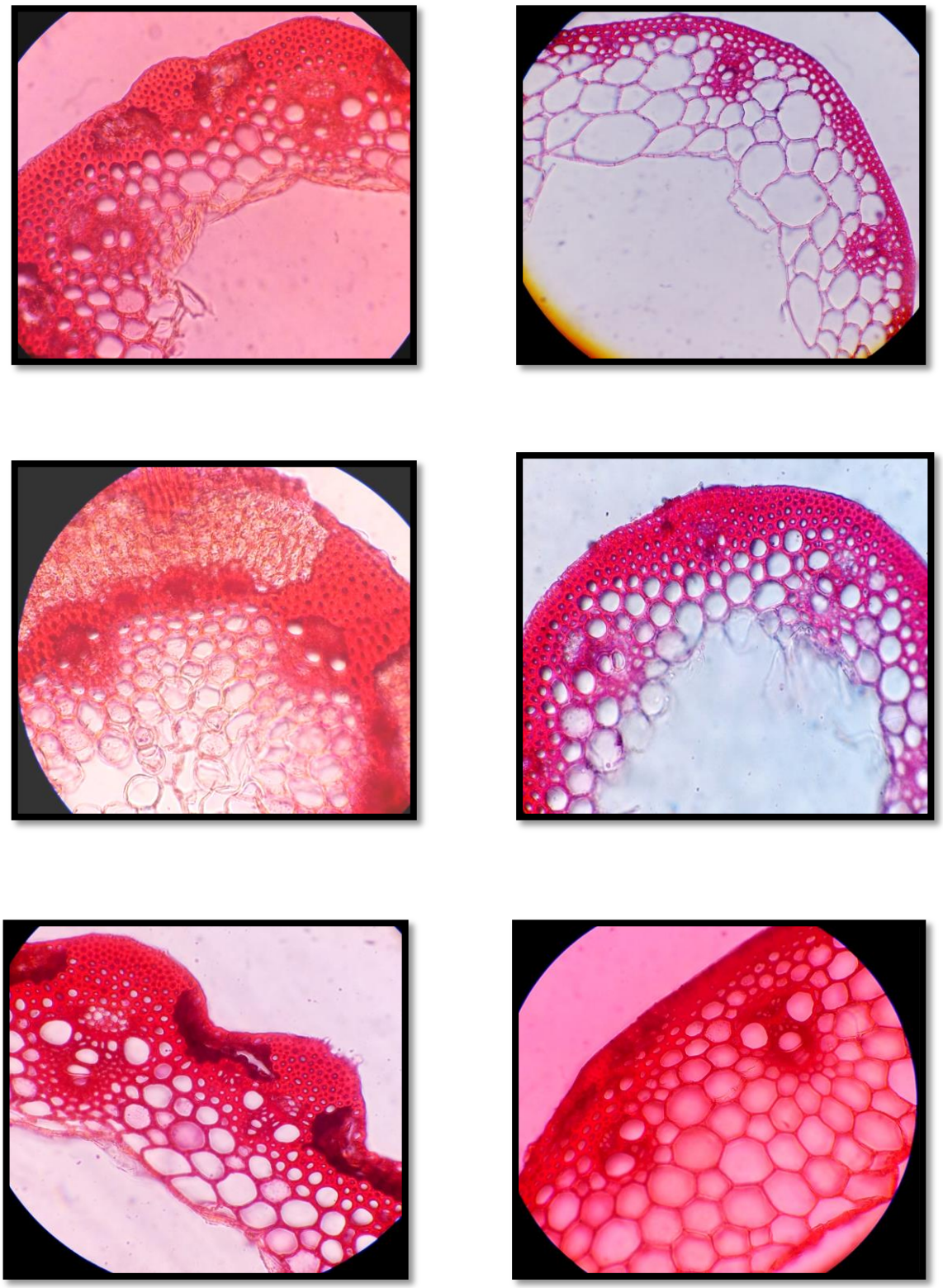


0.24 mm

Figure1: Culms cross section of *Poa* L. species
Mvb: Major vascular bundle, D.P.: Destroyed parenchyma. Sc.C: Sclerenchyma cell. M.P.: Macro Prickles

Table (1) Characters of stem cross sections for studied taxa

Species	Diameter of cross section in (Mm)	Length of major vascular bundle in (µm)	Width of major vascular bundle (µm)	No. of cell rows in sclerenchyma layer (µm)
Poa angustifolia	**0.66 – 0.75 (0.71)**	**90.0 – 122.5 (106.3)**	**70.0 – 105.0 (85.6)**	**8.0-10.0 (9.3)**
Poa annua	**0.58 – 0.63 (0.6)**	**47.5 – 62.5 (55.6)**	**47.5 – 70.0 (56.3)**	**3.0-6.0 (4.5)**
Poa araratica	**0.73 – 0.76 (0.75)**	**67.5 – 92.5 (83.8)**	**77.5 – 92.5 (84.4)**	**8.0-15.0 (9.5)**
Poa bulbosa	**0.43 – 0.51 (0.47)**	**65.0 – 82.5 (73.1)**	**60.0 – 67.5 (63.1)**	**5.0-8.0 (6.5)**
Poa pratensis	**0.39 – 0.51 (0.45)**	**105.0 – 122.5 (114.4)**	**122.5 – 135.0 (128.8)**	**8.0-13.0 (10.3)**
Poa trivialis	**1.69 – 1.76 (1.72)**	**97.5 – 130.0 (113.8)**	**97.5 – 117.5 (106.3)**	**6.0-9.0 (7.3)**



132 µm

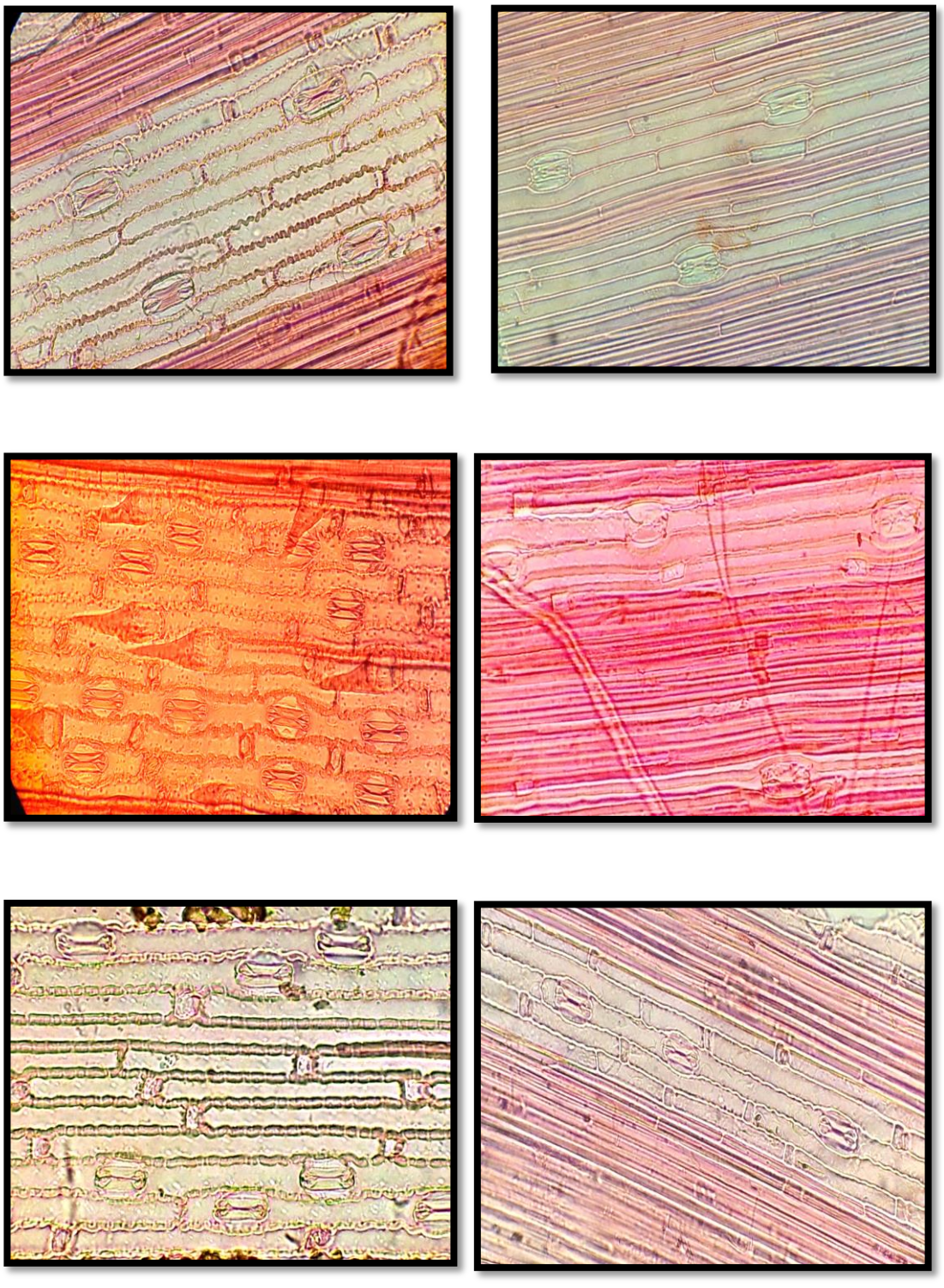
Figure 2. Peripheral and Major Vascular Bundle for *Poa* L. species
Mvb: Major Vascular Bundle. Sc.C.: Sclerenchyma cells. D.p..: Destroyed paranchyma

Table (2) Characters of stem epidermis for studied taxa

Species	Length of long cells in stomatal row (µm)	Length of long cells in non stomatal row (µm)	Stomatal length (µm)	Stomatal width (µm)	No. of single short cell	No. of silica cell paired with cork cell
Poa angustifolia	110.0 -155.0 (131.3)	62.5-207.5 (148.1)	45.0-50.0 (47.5)	27.5-32.5 (29.4)	6.0 – 15 (9.6)	8.0 – 18.0 (12.3)
Poa annua	97.5- 330.0 (220.6)	382.5-552.5 (445.0)	32.5-40.0 (36.3)	17.5-22.5 (20.6)	3.0 – 6.0 (4.6)	Non
Poa araratica	42.5-77.5 (61.3)	42.5-102.5 (73.1)	35.0-42.5 (38.8)	27.5-30.0 (28.8)	15.0-27.0 (21.5)	14.0 – 26.0 (20.5)
Poa bulbosa	92.5-167.5 (134.4)	137.5-297.5 (238.1)	25.3-32.5 (28.8)	12.5-17.5 (15.0)	11.0-18.0 (14.0)	Non

Poa pratensis	47.5 – 92.5 (77.5)	90.0-355.0 (210.0)	27.5-35.0 (31.3)	17.5-25.0 (21.3)	10.0 – 16.0 (12.8)	8.0-15.0 (11.7)
Poa trivialis	40.0-102.5 (68.8)	52.5-135.0 (83.8)	20.0-27.5 (23.8)	15.0-20.0 (17.5)	13.0-16.0 (14.5)	5.0 – 9.0 (7.0)

Note: Numbers between brackets is the average , while the others is the minimum values on the left and maximum on the right .



69 µm

Figure 3. Variation in culms epidermis of *Poa* L. species

Lo: Long cell. St: Stomata. SSC: Solitary short cell. CC: Cork cell. SC: Silica cell. m.p.: Macro prickles.

Stem epidermis

It's commonly known that Poaceae epidermis contain stomatal rows and non stomatal rows, these rows are varied in different characters between different taxa, this epidermis is consist of long cells, short cells, stomata and indumentum.

Long cell in stomatal rows varied from (40.0-102.5) µm in *Poaararatica* and *Poatrivialis*to (110.0-155.0) µm in *Poaangustifolia* while other taxa are ranging between these two values, since in non stomatal rows Poa arrara shows the lowest values in the length of long cell(42.5-102.3) µm but highest values appear in *Poaannua* (382.5-552.5) µm.(Table 2).

The significant features of long cell are rectangular, straight in *Poaannua*, *Poabulbosa, and Poatriviales*and pitted only in *Poabulbosa* while it was slightly undulating, thicken and pitted in the rest of species.(Figure3).

Short cells varied from (4.6) µm in *Poaannua* to (21.5) µm in *Poaararatica*, this cell often present solitary and in pairs of silica bodies sometime, *Poaannua* and *Poabulbosa* have only short cells and the other four taxa has both of them. All studied taxa are glabrous except of *Poaararatica* which have macro prickles. (Table 2, Figure 3).

Stem stomata ranged from the shape to the diameter, the biggest diameter length and width was in *Poaangustifolia*(45.0-50.0) (27.5-32.5) µm, and the smallest values was (20.0-27.5) µm length of *Poatriviales* and (12.5-17.5) µm width of *Poabulbosa*. Since stomata of the grasses can be classified according to the shape of its subsidiary cells and can be used in taxonomic purposes (14), therefore the stomata of the studies taxa has parallel sided subsidiary cells of all species, *Poaararatica*,*Poapratensis* and *Poatrivialis*has Dome shaped stomata while high flat-topped shaped reported in *Poaannua* and *Poabulbosa*and Dome to flat-

topped in *Poaangustifolia*(table 2.figure 3).

Discussion

In the past accumulation of an extensive body of literature on anatomical characters with attendant problems of lack of uniformity, valuable data, definitions and descriptions commonly not applicable to the family, this problem was greatly clarified by the publication in 1960 of anatomy of monocotyledons by C.R. Metcalfe (9).

Taxonomists depends on several qualitative and quantitative characters to separate taxa into different groups, thus this paper depends on anatomical characters of culms of sex species of the genus *Poa* L. of the tribe Festuceae in Iraq which showed good results in recognition between these taxa, the shape of sclerenchyma girdle, diameter of cross section and diameter of major vascular bundles which are all show variation among studied taxa with taxonomic significance . This results has been reported for the first time here in Iraq.

This study also exposed that the sclerenchyma layer which bounded the epidermis was continuous and discontinuous into girders which support the investigation of (10).Stomata of *Poa* species are from paracytic type, short cells present in all studied taxa in pair except of

Poaannua and *Poabulbosa* which has only single short cells, long cell anticlinal walls varies from the thickness and undulation that clarify good characters to distinguish between species however the diameter.

According to what mention above anatomical characters can be consider to have considerable values which provide additional support to morphological, chemical characters and Molecular systematic characters .

Conclusion

The presence of macro prickles is a good taxonomic characters for the species *Poaararatica* while

stem epidermis of other species were glabrous, and this study is also supported the conclusion of Esau (1974) that the sclerenchyma layer of most species of the Poaceae are bounded to the epidermis either its continuous or discontinuous into strands or girders.

Furthermore anatomical characters are not significant enough to support the taxonomy of generic groups, and it can be considered to be additional support for other systemic values.

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دراسة تشريحـــــية مقارنة لسيقان بعض انـــــــواع الجنس .L *Poa* العائـــــلة (Poaceae) في العراق

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المستخلص

تـــم اجراء الدراســـــة التشـــريحية على ستـــــــــة انواع تابعة للجنس .L *Poa* من العائلة Poaceae في العـــراق , و هـــــــي (Poa*angustifolia*L., *Poa annua*L., *Poa ararat*ica*Trautv., *Poabulbosa*L., *Poa pratensis*L. *and Poa trivialis*L.) تضمنت الدراسة الحالية توضيح الصفات الكمية والنوعية الخاصة لبشرة السيقان والمقاطع المستعرضة فيها لدعم واسناد الدراسات السابقة لهذا النوع من الدراسات.

اظهر الاختلاف في قطر الساق , سمك السكلرنكيما وتوزيعها , عددها , شكل وطول الحزم الوعائية تغايرات واضحة ومهمة بين الأنواع ساهمت في عزل الأنواع التابعة لنفس الجنس وتصنيفها . تم توضيح الصفات الخاصة بأبعاد الثغور وأشكالها وأيضا صفات الخلايا الطويلة والقصيرة والكساء السطحي في جداول , كما تم إدراج الصور التشريحية الخاصة بالأنواع قيد الدراسة.

الكلمات المفتاحية : تشريح الساق , الجنس *Poa* , العراق

البحث مستل من اطروحة دكتوراه للباحث الاول.