DOKUZ EYLÜL UNİVERSITY
GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

CYTOTAXONOMICAL, ANATOMICAL AND MORPHOLOGICAL RESEARCHES ON SOME SIDERITIS L. SPECIES

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by
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SUMMARY

this research work, anatomical, morphological and cytotaxonomical aracteristics of **Sideritis leptoclada** O. Schwarz & P. H. Davis, **albiflora** Hub. -Mor., and **S. phrygia** Bornm. species distributed in West Anatolia examined.

The findings of those 3 endemic **Sideritis** L. species belong to our study subject, were not found in the literature, and were not observed, therefore, for the first time they were observed by us.

Morphological characteristics of the species show differences in some ways from Davis' (1982-1988) data, and they are given in the text. Anatomical characteristics of the observed 3 endemic **Sideritis** L. species were compared to **S. congesta, S. arguta** and **S. trojana** and each others. Leaves of **S. leptoclada** O. Schwarz & P. H. Davis and **S. phrygia** Bornm. were found as ecvifasial and amphistomatic, and leaves of **S. albiflora** Hub. -Mor. were found as bifasial and hypostomatic. Other anatomical characteristics more or less show similarities to each others.

Observed 3 endemic **Sideritis** L. species were investigated for the first time in cytotaxonomical point of view, and their chromosome numbers were counted as **S. leptoclada** O. Schwarz & P. H. Davis 2n=32, **S. albiflora** Hub. -Mor. 2n=32, and **S. phrygia** Bornm. 2n=32.

Ö Z E T

Bu araştırmada Batı Anadolu'da yayılış gösteren **Sideritis leptoclada** O. Schwarz & P. H. Davis, **S. albiflora** Hub. -Mor. ve **S. phrygia** Bornm. türlerinin anatomik, morfolojik ve sitotaksonomik özellikleri incelenmiştir.

Araştırma konusu kapsamına aldığımız bu üç endemik türün tespit edilen özelliklerinin literatürde yer almadığı ve incelenmediği dikkate alınarak ilk kez tarafımızdan ele alınmıştır. Orjinal şekil ve bulgular metinde belirtilmiştir.

Türlerin morfolojik özellikleri DAVIS (1982-1988) verilerinden bazı farklılıklar göstermektedir ve bu farklılıklar metinde verilmiştir. İncilenen bu üç endemik **Sideritis** L. türlerinin anatomik özellikleri **S. congesta, S. arguta** ve **S. trojana** ile ve birbirleriyle karşılaştırılmıştır. **S. leptoclada** O. Schwarz & P. H. Davis ve **S. phrygia** Bornm.'nın yaprakları ekvifasial ve amfistomatik, **S. albiflora** Hub. -Mor.'nın yapraklarının bifasial ve hipostomatik olduğu tespit edilmiştir. Diğer anatomik yapılar az çok birbirlerine benzerlik göstermektedir.

İncelenen 3 endemik **Sideritis** L. türü sitotaksonomik yönden ilk kez incelenmiş ve türlerin kromozom sayıları tespit edilmiştir. **S. leptoclada** O. Schwarz & P. H. Davis türünün 2n=32, **S. albiflora** Hub. -Mor. türünün 2n=32 ve **S. phrygia** Bornm. türünün 2n=32 kromozoma sahip olduğu tespit edilmiştir.

ACKNOWLEDGEMENTS

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1. INTRODUCTION

As the beginning date of floristic researches on Turkey are accepted early 18^{th} century. First floristic botanic studies in our country have been done by a French botanist Joseph PITTON de TOURNEFORT, between the years 1700 and 1702. Many researchers took part in fixing the flora of Turkey, but the main contribution has been done by BOISSIER (1810-1885). And another important researcher who studied in North and North-East Anatolia was P. TCHITATCHEFS. In addition to these researchers, H. K. HAUSSKNECHT (1838-1903) studied in North-East and South-West Anatolia, and HANDEL-MAZETTI (1882-1940) studied in North Anatolia.

In the last years, RECHINGER, REGEL, HUBER-MORATH, WAGENITZ, and DAVIS were the last generation of foreign researchers who studied on flora of Turkey. Recently, in addition to these foreign researchers, Turkish botanists have also studied on flora of Turkey. Thus, they have accelerated to bring out flora and vegetation of our country. These studies were carried out by A. BAYTOP, T. BAYTOP, H. BİRAND, H. DEMİRİZ, B. KASAPLIGİL, H. KAYACIK, F. YALTIRIK, N. ZEYBEK, H. PEŞMEN, etc (Seçmen, 1980; Tur. Çev. Sor.Vakfı, 1991).

Davis has reviewed and compiled all of the studies on flora of Turkey, and has made an extensive research with a hard floristic study and has completed his studies in a 10 volume book which was named as "Flora of Turkey and East Aegean Islands". The last volume of the book is the suplement. After his long studies, related to the book, there are 10245 plant taxa in Turkey. 3432 of them are endemics. Thus, endemism ratio of our country is %33,5 (Davis, 1988).

Plants, which distribute only certain places of the earth, which are in a limited area, are endemic plants(Özhatay). Turkey is the richest country in the middle east from the point of the endemic plants number (ICUN, 1980; Anşin, 1982). Endemics exit nearly in all parts of our country, but the most important regions are; Middle Taurusus (between Ermenek, Gülnar and Mut), Antitaurusus (around Saimbeyli and Maraş), the region which include Van, Siirt, Bitlis and Hakkari, the high mountains around Rize and Artvin, between Gümüşhane and Erzincan with Munzur Mountains and Ilgaz Mountains. Around Tuz Gölü (Salt Lake) is especially rich with halophytic endemics.

There are two types of endemics:

1- Paleoendemics

2- Neoendemics

Paleoendemics: Also, called conservative endemics. Plant forms which remained from geological periods (relict). During the geological periods they had a wide spread area, but with the changing of climate conditions and the other similar reasons, they are in a limited isolated area, and they have lost their distribution ability. For example, Carboniferous fossils show that, **Sequoidendron giganteum** (Mamut ağacı) has covered all of the North hemisphere. Today, they only exist in California, Sierra Nevada Mountains as forests (Seçmen, 1980; Yaltırık, 1989). If we give an example from our flora; taxa which belong to **Liqudambar** Mill. genus, according to paleontological findings, in geological periods of Chalk, Tersier, Pleistosen and Eosen they were in North America and the large parts of Eurasia. But after Glacial period they remained in today's distribution area (Yaltırık, 1989). Our natural species **L. orienthalis** mill. (Günlük, Sığla or Sığala ağacı) is the same type of an endemic and relict species (Kesercioğlu, 1973). The remaining species from Tersier exist only in S. W. Anatolia today. Fossil leaves printes of the species were found in the North of Ankara in Kızılcahamam, in Tersier beds (Efe, 1987). The other important point of relict plants; all of the relicts are not endemics. For instance, Platanus however, remained from geological periods, have common distribution area (Seçmen, 1989).

Neoendemics: Also, called progressive endemics. These are plants which appeared after the results of new developments. Because of many reasons, a plant species divide into subspecies, and each of these cover a certain place. This kind of neoendemic plants are seen especially in genus which show large form richness, e.g. **Centaurea** and **Hieracium**. On the other hand, neoendemics are not isolated. For this reason, number of neoendemics are more than paleoendemics. Passage regions have many endemic plants, and also, the climatic variety effect them (Seçmen, 1988).

Many plants which distribute in Turkey also have medicinal and economical value. Some of these plants are endemics. On the other hand, scientific researches showed that some plants which have no economical value in our country, can be used in cultivated plant breeding as gene reserves for their valuable characters.

Our natural plant numbers are more than many European countries. Many natural and cultivated plants have been searched. But in our country, researches especially on endemic plants which are destroyable and spreading in a scant area are not sufficient. Some researches which had been done, were limited with floristic researches.

One of the genus in our country is **Sideritis** L. (**Lamiaceae**) which is rich from the endemic species point of view. First detailed knowledge of **Sideritis** L. species are seen in the book of "Flora Von Mittel Europa" by HEGI (1964). According to Hegi, there are about 60 **Sideritis** L. species in the earth, and he investigated them under the name of 5 sections. They are in following order:

1. Hesiodia: Annual. They are found throughout the Mediterranean region.
2. Burgsdorfia: Annual. They are found throughout the Mediterranean region.
3. Eusideritis: In semi-shrub form. They found from West Mediterranean Mountains to West Alp Mountains, a lot more in Spain.
4. Empedoclea: Perennial. They are found in West Mediterranean region.
5. Marrubiastrum: In bushy form. They are found in Canary Islands to Madeira.

According to Hegi, distribution of the annual forms of this genus like **S. montana** was carried out in the form of mixed clover-like plant seeds (Hegi, 1964). On the other hand, TOMAS-BARBERAN and his friends (1988), in their research on North African **Sideritis** L. species, have recorded that 140 **Sideritis** L. species existing throughout the Mediterranean region including Canary Islands and Madeira (Contandriopoulos, 1978). And they have also recorded that this is a taxonomically difficult genus, which requires extensive experimental investigations (Heywood).

40 species of this genus which belong to Hesiodia and Empedoclea sections exist in Turkey, especially in South Anatolian region, and 31 of them are endemics. Endemism ratio of this genus for Turkey is %77,5 (Davis, 1988).

Herbas of **Sideritis** L. species have long been used as tea and folk medicine by the local people. It is also known that **S. scardica** has been used as decoction solution, in Bulgaria, Albania, Macedonia, and Russia; **S. romana** is used as tea in France; **S.hirsuta, S. scardioides, S. hyssopifolia,** and **S. montana** are used as tonic, against fever and to hysteria in different European countries (Sezik, 1983).

Furthermore, tea of **S. chlorostegia** and **S. catillaris** are drunk around Crimea (Komarov, 1955). **S. cretica** is used in Greece as medicinal tea (Komaitis, 1985). The aerial parts of **S. revechonii** (Adzet, 1989), **S. angustifolia** (Sanchez, 1987), **S. tragoriganum** ssp. **nova, S. funkiana, S. incana** ssp. incana, **S. incana** ssp. **sericea, S. incana** ssp. **glauca** (Villar, 1986), **S. javalambrensis, S. leucantha, S. tragoriganum** ssp. **tragoriganum, S. scordioides** (Villar, 1985a), and **S. mugronensis** (Villar 1985a; Villar 1985b) are used in Spain as folk medicine for their antiinflammatory and antirheumatic properties (Villar, 1985c; Alcaraz, 1985). **S. taurica** which distribute from Crimea to Anatolia and Caucasus is extremely decorative and semishrub form, densely white hairy species. It is seldom cultivated for decorative purpose (Hegi, 1964; Komarov, 1955).

Using **Sideritis** L. species as folk medicine and tea is very common in South Anatolia (Sezik, 1983). Usage forms of them are %1-5 infusion, practical method for prepearing infusion of these plants as follows: A flowering stem or a few leaves are put into a glass of hot water. Let them remain in the hot water untill yellow color comes out. Then the drog peace is taken back. The prepeared infusion is sweeten by some sugar and it is ready to drink (Baytop, 1984).These species are generally used in the treatment of stomach illnesses and kidney stones, as diurethic, and sometimes used for fever (Baytop, 1984).

Different local names are given to **Sideritis** L. species. According to obtained data, table.1 is originally prepeared.

Except anatomical and morphological researches on **S. congesta, S. arguta,** and **S. trojana** there is no other anatomical researches on **Sideritis** L. species.

Furthermore, cytotaxonomical researches on endemic species in our country are few. Sufficient knowledge of chromosome numbers, polyploidi values, and consequently chromosome geographies of these species are not known yet. DARLINGTON (1955) has recorded that the main chromosome number of genus **Sideritis** L. is indefinite, and he has found the chromosome numbers of South European species as 2n=22, 28, 30, 32. LÖVE (1952), in his researches on Middle European **Sideritis** L. species has found the chromosome number as 2n=32. And also, FEDEROV (1969) has reported that the main chromosome

number of the genus is 2n=32. And also, STRID (1965) has fixed the chromosome numbers of foreign samples of **S. curvidens** (2n=28) and **S. lanata** (2n=30) which also distribute in Turkey. CONTANDRIOPOULOS (1978) who has done cytotaxonomical studies on **Sideritis** L. species, has fixed the chromosome numbers of some **Sideritis** L. species which spread Anatolia. They are as follows:
S. bilgerana 2n=34, **S. brevibracteata** 2n=32, **S. congesta** 2n=32, **S. libanotica** ssp. **libanotica** 2n=32, 34,**S. libanotica** ssp. **linearis** 2n=32, 32+0-2B, 32+2B, 34+B, **S. phlomoides** 2n=32, **S. pisidica** 2n=32, **S. stricta** 2n=32, **S. tmolea** 2n=32.Except these studies, no other cytological researches on **Sideritis** L. species spreading in Turkey can be found.

According to book of "List of Rare, Threatened, and Endemic Plants in Turkey" which has been prepeared, according to IUCN Red Data Book Categories, by EKİM and his friends (1989), generation of many **Sideritis** L. species are endangered. According to the book,especially following 3 West Anatolian species which are included in my research subject, are in "Rare" category, which means, their generation are endangered.

Because there is no sufficient source in this area, on **Sideritis leptoclada** O. Schwarz & P. H. Davis, **S. albiflora** Hub.-Mor., and **S. phrygia** Bornm., which have an important place in our countries economy and many of them are used as medicinal tea, these anatomical, morphological and cytotaxonomical researches and observations have been done.

Table 1: Names of Some **Sideritis** L. Species According to Their Usage Regions, Used Parts as Drogs, and Medicinal Effects.

Species	Usage Regions	Local Names	Used Parts	Medicinal Effects
S.sipylea	İzmir;Kemalpaşa Ödemiş.Manisa	Adaçayı	Flowering stems and leaves	In the treatment of stomach illnesses and fever.Used as diurethic, stimulative,carminative,appetizer
S.stricta	Ant.Korkuteli	Dağçayı	" "	" " "
	Ant.Kepez	Tilki kuyruğu Dokuz donlu		
S.tmolea	İzmir;Ödemiş	Balbaşı Sivriçay	" "	" " "
S.congesta	Ant.Alanya	Yaylaçayı Dağçayı	" "	" " "
S.arguta	Ant.Gündoğmuş	Yaylaçayı	" "	" " "
S.leptoclada	Muğla;Marmaris Dalaman,Köyceğiz	Kızlan	" "	" " "
	Denizli;Eskere	Kırtıl	" "	" " "
S.albiflora	Muğla;Marmaris Dalaman,Köyceğiz	Bozlan	" "	" " "
S.argyrea	Ant.Gündoğmuş	Eşekçayı	" "	" " "
S.bilgerana	Konya	-	" "	" " "
S.hispida	Konya	-	" "	" " "
S.trojana	Çanakkale	Kazdağıçayı	" "	" " "
S.phrygia	Afyon;Çay	Çayotu	" "	" " "
S.syriaca	Antalya G.D.Anadolu Böl.	-	" "	" " "
S.libanotica	Ant.Elmalı	Dağçayı	" "	" " "
S.libanotica ssp.linearis	Ant.Elmalı Alanya,Akseki	İnceçay	" "	" " "
	Mersin;Erdemli	Yaylaçayı		
	Den;Çiv.Baklan Konya;Ermenek Afyon Çay	Çayotu		
	Kayseri.K.Maraş	Altınbaş		
	Muğla;Köyceğiz Fethiiye	Acem arpası Çalıçayı		
S.pisidica	Ant.Elmalı	Dağçayı Eldivançayı	" "	" " "
	Ant.-Muğla	Çay çalbası		
	Fethiye	Yayla çayı Akdağ çayı		
S.perfoliata	Bal.Edremit Isparta-Konya	Yayla çayı	" "	" " "
	Ant;Elm.,Alanya	Dağ çayı		
	İzm;Bor;Kayadibi	Cazık çayı		
S.libanotica ssp.linearis	Van-Bitlis Siirt-Hakkari-Şanlı Urfa	Yara otu	" "	" " "
			Leaves	Used as a blood coagulator and used for skin eruptions

2. MATERIAL and METHOD

2. 1. Material

Sideritis leptoclada O. Schwarz & P. H. Davis, **S. albiflora** Hub.-Mor., and **S. phrygia** Bornm. species have been used as observation materials. In our studies, alcohol and herbarium samples of stems, flowers and seeds of those species that have been provided from following localities of West Anatolia, were used:

S. leptoclada O. Schwarz & P. H. Davis

1) C1: Muğla; Dalaman; the way of Kayadibi Village, Çayiçi place, 50-150m, 4. 8. 1991, Aydın 001.
2) C1: Muğla; Dalaman; Kayadibi Village, place of Kavaklıdere, Hayıtdere hill, 350m, 4. 8. 1991, Aydın 002.

S. albiflora Hub.-Mor.

1) C1: Muğla; Dalaman; the way of Kayadibi Village, in front of Demirci ini, 250m, 4. 8. 1991, Aydın 003.
2) C1: Muğla; Dalaman; Around Kayadibi Village, 300m, 4. 8. 1991, Aydın 004.

S. phrygia Bornm.

1) B3: Afyon; Çay; From Yakasinek Village to Sultandağ, 1500-1600m, 19. 7. 1991, AARI (Ege Tar. Ar. Ens.) 0302.

2. 2. Method

2. 2. 1. Researches of Germination Experiments

The fertile seeds of **S. leptoclada** O. Schwarz & P. H. Davis, **S. albiflora** Hub.-Mor., and **S. phrygia** Bornm. species were used for the germination experiments in petri dishes. A pair of filter paper were placed in the petri dishes. The chosen seeds were leave in fresh water at 20^{o}C about 1 or 2 hours before they were placed into the petri dishes. After that, the seeds were put into the petri dishes and applied them hot and cold shock. First group were kept at 4^{o}C a night, second group at -5^{o}C a night. The following day, they were allowed for germination at 20^{o}C. Here, two different groups were applied. First group was allowed for germination in continious darkness and the second one in continious light, so that, the seeds germinate better. A control group was responsible for each group.

2. 2. 2. Researches of Determining Morphological Characteristics

Photographs of **S. leptoclada** O. Schwarz & P. H. Davis, **S. albiflora** Hub.-Mor., and **S. phrygia** Bornm. were taken and the morphological shapes of the samples were drawn. Maximum, minimum or mean-values of the morphological measurements have measured from 50 samples were given. In establishing morphological characteristics profitted from "Flora of Turkey and East Aegean Islands" prepeared by P. H. Davis (1965-1988).

2. 2. 3. Researches of Determining Anatomical Characteristics

For examining the anatomical characteristics of each species, cross sections were taken from the roots, stems and leaves of the plants, and also, transverse sections were taken from the lower and upper epidermis by hand. Photographs of the determined anatomical characteristics were taken in microphotography apparatus. In determination of the anatomical characteristics, anatomical atlas and lesson books were used as source materials (Hasman, 1955; Vardar, 1962 & 1970; luttgz, 1971; Strasburger, 1973).

2. 2. 4. Researches of Determining Cytological Characteristics

Germination of seeds, which had been placed in the petri dishes, of each species have been observed and left untill the root tips become 1 cm in length. Root tips have been taken by a sharp razor blade and one part of them have been applied to prefixation with 8-oxiquinoline or Alpha-Brom-Naphtalen. Both different groups of root tips have been fixed by carnoy solution (3 Alcohol and 1 Glacial Acetic Acit). The root tips have been tried to stain by acetocarmin and acetoorcein dyes. It has been seen that acetoorcein was the most effective dye (Rosen, 1947; Kawono, 1963; Kesercioğlu, 1973). In preparations prepeared from root tips, the division stages have been examined in mitosis phases. The shapes of the chromosomes have been drawn by the help of camera lucida.

3. RESULTS

3. 1. Results of Morphological Characteristics of Observed Sideritis L. Species

3. 1. 1. S. leptoclada O. Schwarz & P. H. Davis, in Kew Bull. 1949: 418(1949).
Synonym: Absent.

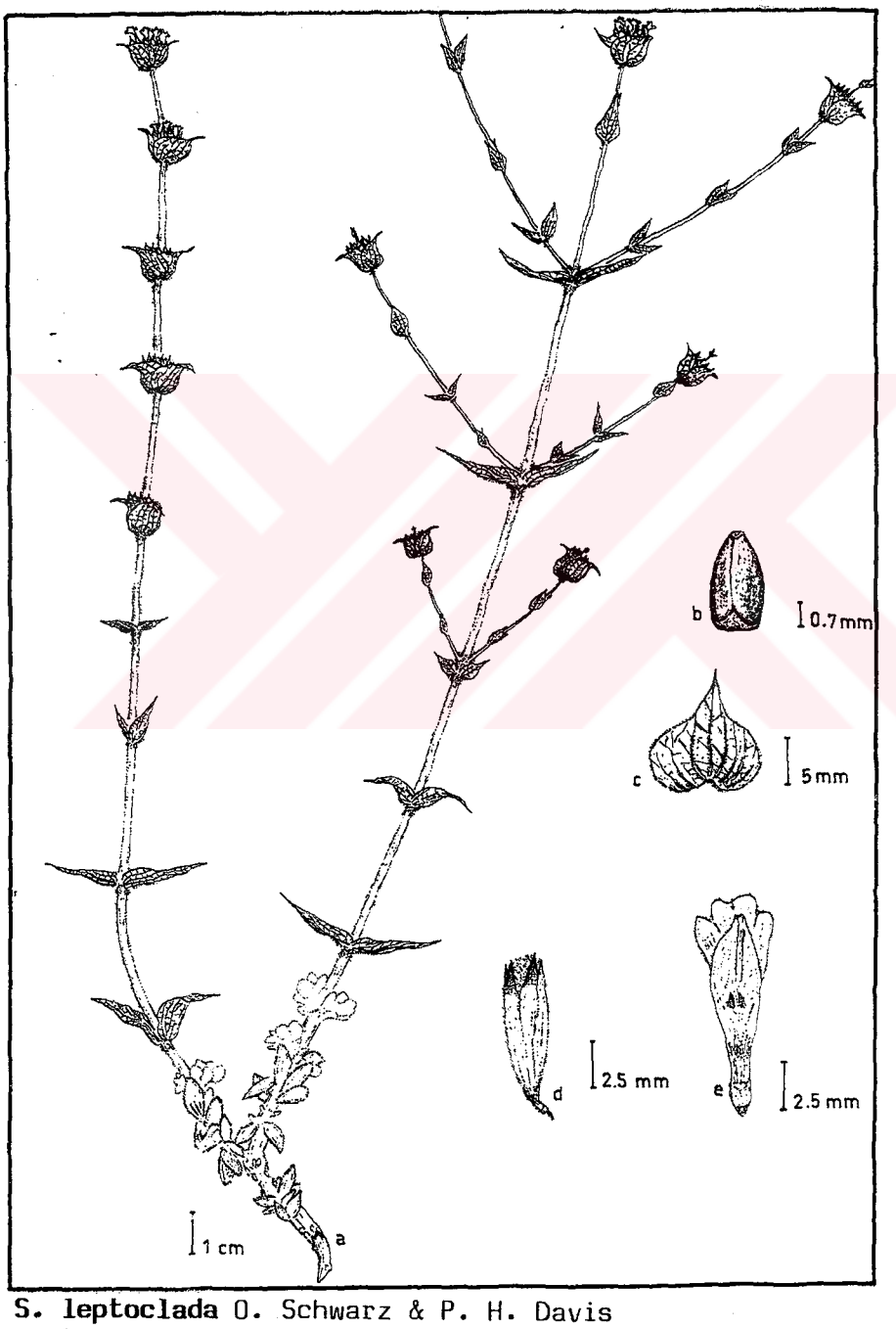

Figure 1: **S. leptoclada** O. Schwarz & P. H. Davis
a- General appearance; b- Fruit; c- Bract; d- Calyx; e- Corolla

It is a perennial, herbaceous or shrub type, 20-95 cm long plant. It has a woody root. Stem has four corners, and it is simple or little branched. It is covered densely adpressed white-tomentose hairs below; loosely tomentose with spreading eglandular hairs and short glands above, glabrescent. Cauline leaves are 6-8 paired with internodes to 7 cm, middleones are oblanceolate to lanceolate-linear shaped, 1,5-5 cm long and 0,3-0,7 cm wide, acute, rounded or semi-amplexicaule shaped at base, finely crenate-serrate, and sessile. Both surfaces of the leaves have long eglandular hairs, upper surface is more densely hairy, and glandular hairs are present on both surfaces. Verticillaster numbers are 3-10, each of them has 6 flowers, internodes between them are 1-6 cm. Bracts are leaf shaped, middle ones are amplexicaule, orbicular to cordate and reniform shaped, acùminate, 0,9-1,4 cm long with 1-5 mm acumen, and 0,9-1,5 cm wide. It is glandular-pubescent, and ciliate. Calyx is 7-8 mm long with short glands and less numerous eglandular hairs. It has 5 equal teeth. They are triangular-lanceolate shaped and 2,0-2,8 mm long with yellow mucro to 0,5 mm. Corolla is yellow and dioecious with 2 lips. Upper lip has 2 lobes, and lower lip has 3 lobes. It is 9-12 mm long and hairy inside. Androeciums are 4 and didymous, two of them have short filaments, and the others have long filaments. They are connected to inside of corolla tube. Gynoecium is 1, gynobasic and bifid. Stillus rise inside of corolla tube. Ovary is epigene. It has 2 carpels and 4 sections, and each section has 1 ovule. Placentation is basal. This species has 4 nut shaped seeds. The seeds are 2,8-3,0 mm long and 1,6-1,8 mm wide.Flowering season of the species are June and July. It distributes from sea level to 800 m high. It is resemble much **S. albiflora** and **S. brevibracteata.**

3. 1. 2. S. albiflora Hub.-Mor. in Bauhinia 6 (2): 298 (1978)
Synonym: Absent.
It is a perennial, herbaceous or shrub type, 50-85 cm long plant. It has a woody root. Stem has four corners, and it is simple or little branched. It is covered with densely adpressed white-tomentose hairs, and soon glabrescent. Cauline leaves 6-8 paired with internodes to 10 cm, middle leaves linear-oblong shaped, cuneate, acutish, enlarged, and auriculate at base, 1-5 cm long and 0,2-0,7 cm wide, finely crenulate-serrate, sessile, bearing buds in their axils. Both surfaces of the leaves have densely long eglandular hairs, upper surface is more densely hairy, and glandular

Figure 2: General appeance of **S. leptoclada** O. Schwarz & P. H. Davis

hairs are present on both surfaces. Verticillaster numbers are 3-10, each of them has 6 flowers, internodes between them are 2-11 cm. Bracts are leaf shaped, middle ones are ovate to orbicular shaped, 1-2 cm long with long acumen to 1 cm and 0,9-1,5 cm wide. It is glandular-puberulent. Calyx is 7-9 mm long with spreading eglandular hairs. It has 5 equal teeth. They are 2-3 mm long and lanceolate shaped with interspersed glands and short yellowish mucro. Corolla is white and dioecious with 2 lips. Upper lip has 2 lobes, and lower lip has 3 lobes. It is 10-12 mm long, hairy and with or without brown marking inside. Androeciums are 4 and didymous, two of them have short filaments, and the others have long filaments. They are connected to inside of corolla tube. Gynoecium is 1, gynobasic and bifid. Stillus rise inside of corolla tube. Ovary is epigene. It has 2 carpels and 4 sections, and each section has 1 ovule. Placentation is basal. This species has 4 nut shaped seeds. The seeds are 2,0-2,2 mm long and 1,0-1,2 mm wide. Flowering season of the species are May to July. It distributes from

sea level to 800 m high. It is resemble much **S. brevibracteata** and **S. leptoclada.**

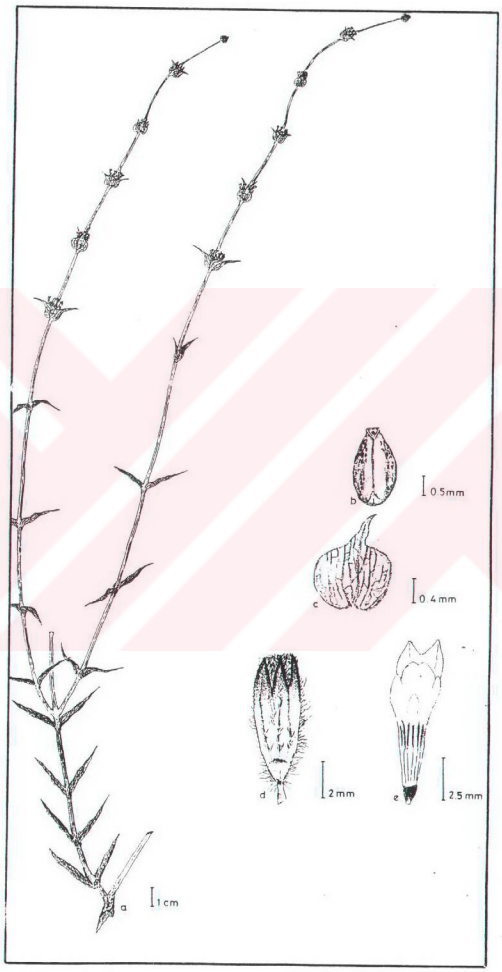

Figure 3: **S. albiflora** Hub.-Mor.
a- General appearance; b- Fruit; c- Bract; d- Calyx; e- Corolla

Figure 4: General appearance of **S. albiflora** Hub.-Mor.

3. 1. 3. S. phrygia Bornm. in mag. Bot. Lap. 31: 133 (1932)
Synonym: **S. condensata** sensu Bornm. in Beih. Bot. Centr. 24 (2): 490 (1909) non Boiss. & Heldr. (1848).

It is a perennial, herbaceous or shrub type, 20-65 cm long plant. It has a woody root. Stem has four corners, and it is simple or little branched. It is covered with adpressed white-tomentose hairs, often glabrescent or with eglandular hairs. Cauline leaves 4-6 paired with internodes between 3 to 6 cm, middle leaves oblong-spathulate to linear-lanceolate shaped, 3-9 cm long and 0,5-1,0 cm wide, finely denticulate, shortly acuminate, sessile or with petiole to 1 cm. Both surfaces of the leaves have densely long eglandular hairs, upper surface is more densely hairy, and glandular hairs are present on both surfaces. Verticillaster numbers are 6-15, each of them has 6 flowers, internodes between them are 1,0-4,5 cm. Bracts are leaf shaped, middle ones are ovat to orbicular and reniform shaped, 1,0-1,8 cm long including 2-5 mm acumen and 0,8-1,8 cm wide. Calyx is 8,0-10,5 cm long and densely hairy. It has 5 equal teeth. They are triangular-lanceolate

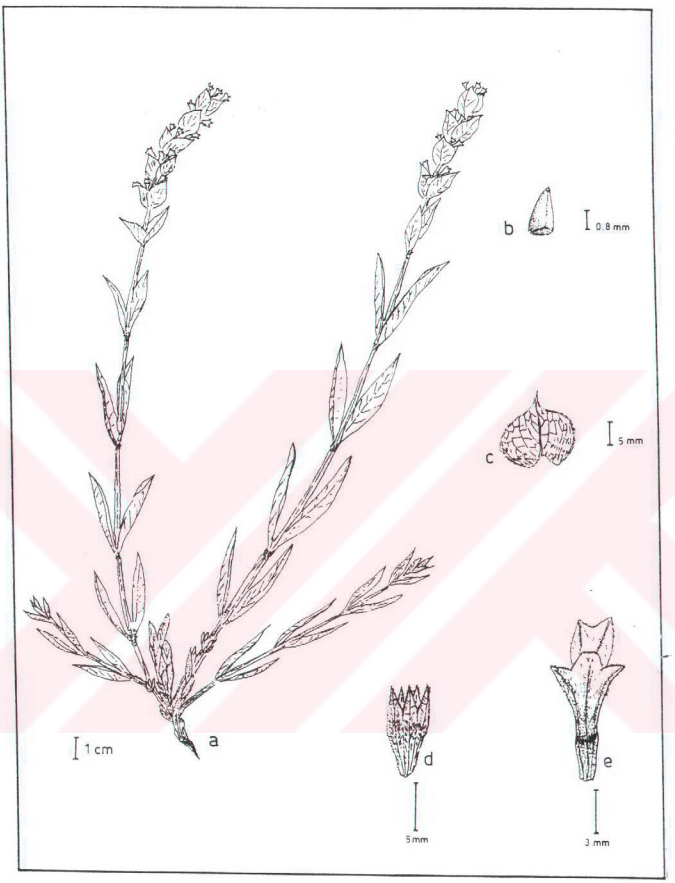

Figure 5: **S. phrygia** Bornm.
a- General appearance; b- Fruit; c- Bract; d- Calyx; e- Corolla

shaped and 3-4 mm long, with spiny tip. Corolla is yellow and dioecious with 2 lips. Upper lip has 2 lobes, and lower lip has 3 lobes. It is 12-14 mm long, hairy and with or without brown striae inside. Androeciums are 4 and didymous two of them have short filaments, and the others have long filaments. They are connected to inside of corolla tube. Gynoecium is 1,

gynobasic and bifid. Stillus rise inside of corolla tube. Ovary is epigene. It has 2 carpels and 4 sections, and each section has 1 ovule. Placentation is basal. This species has 4 nut shaped seeds. The seeds are 1,8-2,0 mm wide. Flowering season of the species are June and July. It distributes from 1100 to 1500 m high. It resemble much **S. amasiaca** and **S. armeniaca.**

Figure 6: General appearance of **S. phrygia** Bornm.

Figure 7: Flowers of **S. phrygia** Bornm.

3. 2. Results of Anatomical Characteristics of Observed Endemic *Sideritis* L. Species

3. 2. 1. Anatomical Characteristics of *S. leptoclada* O. Schwarz & P. H. Davis

Root: In the cross section of the root the following layers can be distinguished: The outer layer of the root is peridermis. Inside the peridermis is the layer of cortex, which consist of cells in 2 or 3 rows. Just below the cortex vascular bundles which consist of xylem and phloem can be seen. They cover a large area. In the middle, pith can be seen. Between the xylem and phloem tissues cambium can be seen in the form of crushed layer. Xylem which covers a large area, composed of tracheas and tracheids, and sclerenchymatous cells can be seen in heaps. Pith rays consist of cells in 2 or 3 rows. We were not able to find endodermis and pericycle (Figure 8).

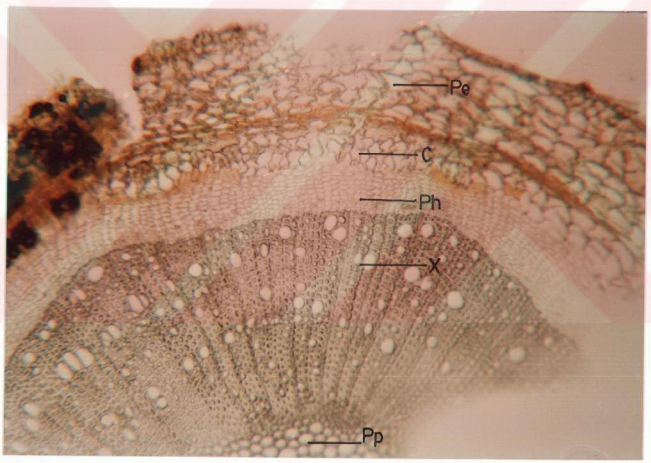

Figure 8: The cross section of the root of **S. leptoclada** O. Schwarz & P. H. Davis (25X)
Pe- Periderm; C- Cortex; Ph- Phloem; X- Xylem
Pp- Paranchymatous pith

Stem: This species typically has four corners which characterized the family **Lamiaceae.** In the cross section of the stem following layers can be seen; The outer layer of the stem is a thin epidermis which covered by a waxy, transparent layer which is called cuticle. Too many glandular and nonglandular hairs emerge from epidermis (Figure 9). The hairs'

characteristics resemble the leaves. Collenchyma layers which contain thick walled cells can be seen on the corners of the stem. A layer of chlorenchyma which is composed of loosely-packed cells containing chlorophyll is placed inside the epidermis. Endodermis which contains circle shaped large cells is just below the chlorenchyma. Inside of the endodermis is a layer which is composed of sclerenchymatous cells. In vascular bundles of the stem there is an outer region known as phloem and an inner one called xylem. A layer of dividing cells are called cambium which separates the phloem from the xylem. In the xylem tracheas, tracheids and less numerous sclerenchymatous cells which are seen in heaps, are found. The pith contains spherical paranchymatous cells, and it covers a large area. Paranchymatous cells in pith become smaller towards xylem and the wall of its cells becomes thick. Pith rays consist of cells in 2 or 3 rows. We were not able to see stomata in the stem (Figure 9a).

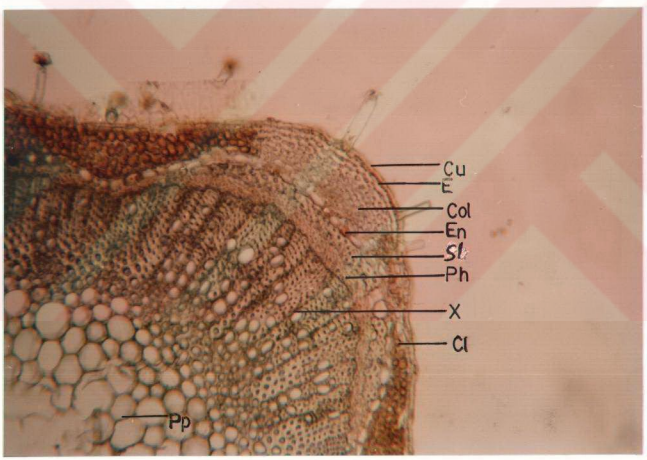

Figure 9a: The cross section of the stem of **S. leptoclada** : O. Schwarz & P. H. Davis (25X)

Cu- Cuticle; E- Epidermis; Cl-Chlorenchyma layer
Col- Collenchyma; En- Endodermis; Sl-Sclerenchymatous layer;
Ph- Phloem; X- Xylem; Pp- Paranchymatous pith

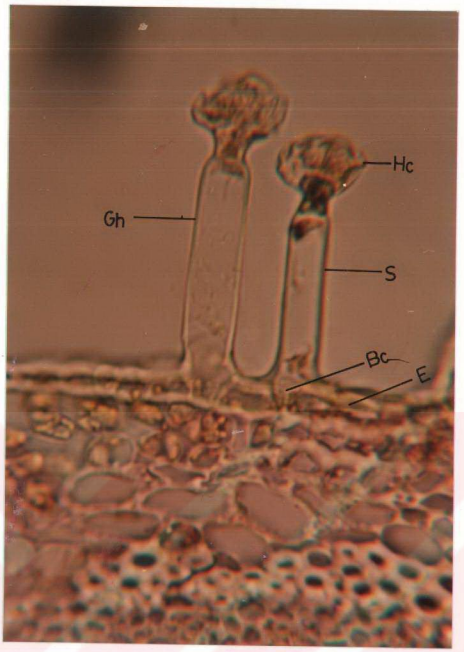

Figure 9b: Glandular hairs in the cross section of the stem of **S. leptoclada** O. Schwarz & P. H. Davis (260X)

Gh- Glandular hairs; Hc- Head cell; S- Stalk; Bc- Base cell; E- Epidermis

Leaf: The following layer can be distinguished in the cross section of the leaf; The upper and the lower surfaces of the leaf are surrounded by a layer called epidermis. The upper epidermis consists of a single layer of cells. Epidermis cells are more or less rectangular and they do not have chlorophyll. Cells of upper epidermis are larger than lower ones. Too many glandular and nonglandular hairs emerge from both surfaces of the epidermis (Figure 10b). Many nonglandular hairs have 1, 2 or 3 cells. Unicellular hairs are both short and long. The hairs are longer on upper surface of the leaf.Multicellular hairs are 4-5 times longer than unicellular hairs. Glandular hairs have multicellular head and long stalk, and have unicellular head and short or long stalk. Glandular hairs have unicellular heads, and stalks which are longer than 3 head cells characterize the **Sideritis** L. genus (Metchalfe, 1950).

The upper epidermis is covered by a waxy, transparent layer called cuticle. Just below the upper epidermis, the mesophyll which consists of cells containing numerous chloroplast can be seen. The mesophyll is divided into two layers; the upper is palisade layer in which the cells are cylindrical and situated side by side, with their longer sides at right angles to the leaf, and the lower is spongy layer whose cells are irregular in shape and loosely packed together. The spongy cells are rounded, thin walled, and also have chlorophyll. Another palisade layer can be seen again under the spongy layer. The air spaces are large, and have irregular cavities among the spongy cells. They are connected with each other and open through the upper and lower epidermis by the way of stomata. The veins containing xylem and phloem tubes and fibres are scattered through the spongy layer. They are accompanied by sclerenchyma. This is xerophytic feature.

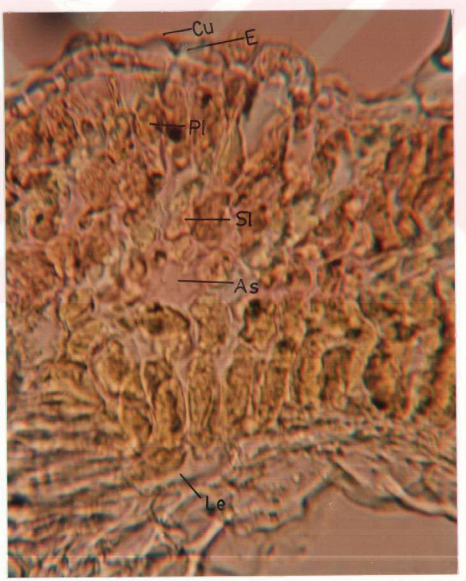

Figure 10a: The cross section of the leaf of **S. leptoclada** O. Schwarz & P. H. Davis (260X)

Cu- Cuticle; Ue- Upper epidermis; Pl- Palisade layer; Sl- Spongy layer; As- Air space; Le- Lower epidermis

The veins are surrounded by a sheat of paranchymatous cells. Under the mesophyll is the lower epidermis. Stomata occur on both surfaces. They are typically jut out from the epidermis. In transverse sections, it is seen that, stomata are diasitic type (Figure 10a; 10c; 10d).

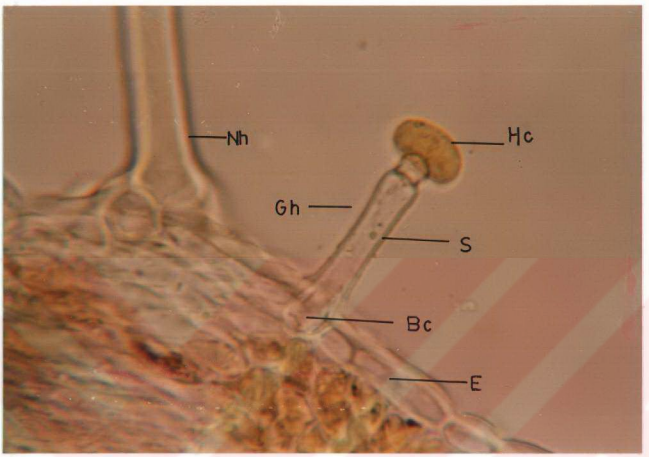

Figure 10b: Glandular and nonglandular hairs in the cross section of the leaf of **S. leptoclada** O. Schwarz & P. H. Davis (260X)

Gh- Glandular hair; Nh- Nonglandular hair;
Hc- Head cell; S- Stalk; Bc- Base cell; E- Epidermis

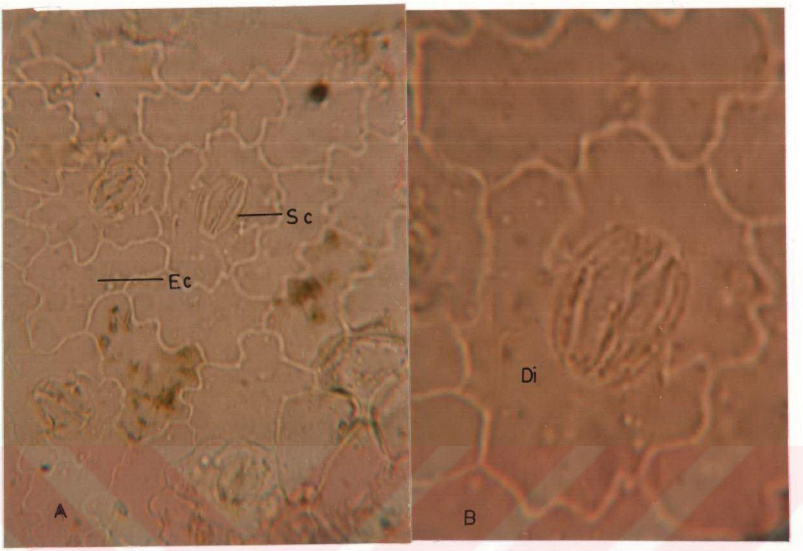

Figure 10c: Upper epidermis in the transverse section of the leaf of **S. leptoclada** O. Schwarz & P. H. Davis (A- 260X; B- 1250X)

Sc- Stoma cell; Di- Diasitic stoma; Ec- Epidermis cell

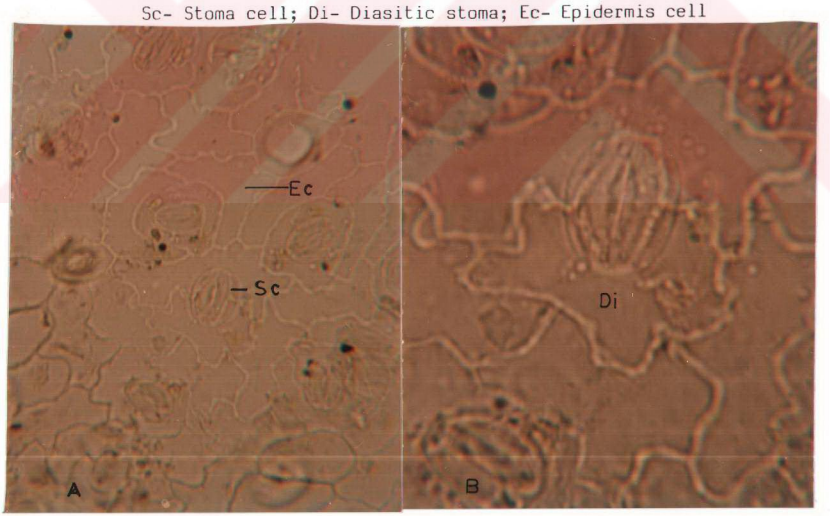

Figure 10d: Lower epidermis in the transverse section of the leaf of **S. leptoclada** O. Schwarz & P. H. Davis (A- 260X; B- 1250X)

Sc- Stoma cell; Di- Diasitic stoma; Ec- Epidermis cell

Pollen: The pollen grains of **S. leptoclada** O. Schwarz & P. H. Davis are tri-colporate in shape and their size is about 100 micron (Figure 11).

Figure 11: The pollen grain of **S. leptoclada** O. Schwarz & p. h. Davis (1250X)

3. 2. 2. Anatomical Characteristics of S. albiflora Hub.-Mor.

Root: In the cross section of the root the following layers can be distinguished; The outer layer of the root is peridermis. Inside the peridermis is the layer of cortex, which consist of cells in 2 or 3 rows. Just below

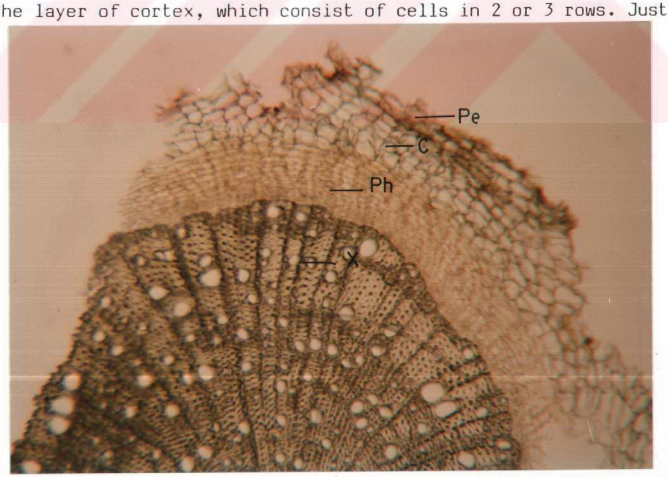

Figure 12: The cross section of the root of **S. albiflora** Hub.-Mor. (25X)
Pe- Periderm; C- Cortex; Ph- Phloem; X- Xylem

the cortex vascular bundles which consist of xylem and phloem can be seen. They cover a large area. In the middle pith can be seen. Between the xylem and phloem tissues cambium can be seen in the form of crushed layer. Xylem which covers a large area, composed of tracheas and tracheids, and sclerenchymatous cells can be seen in heaps. Pith rays consist of cells in 2 or 3 rows. We were not able to find endodermis and pericycle (Figure 12).

Stem: This species typically has four corners which characterized the family **Lamiaceae.** In the cross sections of the stem following layers can be seen; The outer layer of the stem is a thin epidermis which covered by a waxy, transparent layer which is called cuticle. Too many glandular and non-glandular hairs emerge from epidermis (Figure 13b). The hairs' characteristics resemble the leaves. Collenchyma layers which contain thick walled cells can be seen on the corners of the stem. A layer of chlorenchyma which is composed of loosely-packed cells containing chlorophyll is placed inside the epidermis. Endodermis which contains circle shaped large cells is just below the chlorenchyma. Inside of the endodermis is a layer which is composed of sclerenchymatous cells. In vascular

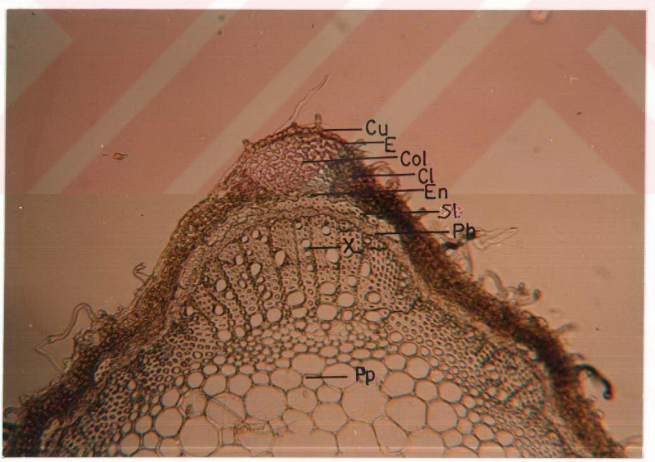

Figure 13a: The cross section of the stem of **S. albiflora** Hub.-Mor. (25X)
Cu- Cuticle; E- Epidermis; Cl- Chlorenchyma layer;
Col- Collenchyma; En- Endodermis; Sl-Sclerenchymatous layer; Ph-Phloem;
X- Xylem; Pp- Paranchymatous pith

bundles of the stem there is an outer region known as phloem and an inner one called xylem. A layer of dividing cells are called cambium which separates the phloem from the xylem. In the xylem tracheas, tracheids and less numerous sclerenchymatous cells which are seen in heaps, are found. The pith contains spherical paranchymatous cells, and it covers a large area. Paranchymatous cells in pith become smaller towards xylem and the wall of its cells becomes thick. Pith rays consist of cells in 2 or 3 rows. We were not able to see stomata in the stem (Figure 13a).

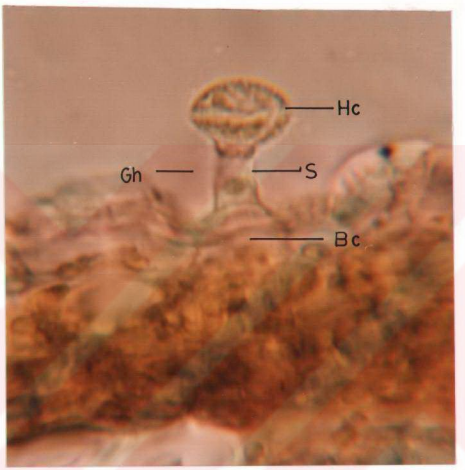

Figure 13b: Glandular hair in the cross section of the stem of **S. albiflora** Hub.-Mor. (1250X)

Gh- Glandular hair; Hc- Head cell; S, Stalk; Bc- Base cell

Leaf: The following layer can be distinguished in the cross section of the leaf; The upper and the lower surfaces of the leaf are surrounded by a layer called epidermis. The upper epidermis consists of a single layer of cells. Epidermis cells are more or less rectangular and they do not have chlorophyll. Cells of upper epidermis are larger than lower ones. Too many glandular and nonglandular hairs emerge from both surfaces of the epidermis (Figure 14b). Many nonglandular hairs have 1, 2 or 3 cells.Unicellular hairs are larger on upper surface of the leaf. Multicellular hairs are 4-5 times longer than unicellular hairs.

Glandular hairs have multicellular head and long stalk, and have unicellular head and short or long stalk. Glandular hairs have unicellular heads, and stalks which are longer than 3 head cells characterize the **Sideritis** L. genus (Metchalfe, 1950). The upper epidermis is covered by a waxy, transparent layer called cuticle. Just below the upper epidermis, the mesophyll which consists of cells containing numerous chloroplasts can be seen. The mesophyll is divided into two layers; the upper is palisade layer in which the cells are cylindrical and situated side by side, with their longer sides at right angles to the leaf, and the lower is spongy layer whose cells are irregular in shape and loosely packed together. The spongy cells are rounded, thin walled, and also have chlorophyll. The air spaces are large, and have irregular cavities among the spongy cells. They are connected with each other and open through the lower epidermis by the way of the stomata. The veins containing xylem and phloem tubes and fibres are scattered through the spongy layer. They are accompanied by

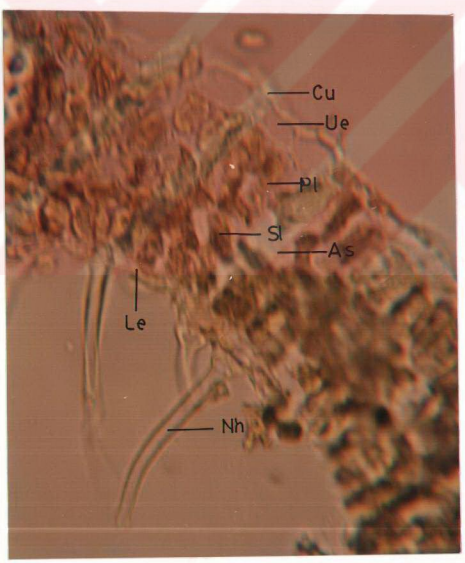

Figure 14a: The cross section of the leaf of **S. albiflora** Hub.-Mor.(260X)
Cu- Cuticle; Ue- Upper epidermis; Pl- Palisade layer;
Sl- Spongy layer; As- Air space; Le- Lower epidermis;
Nh- Nonglandular hairs.

sclerenchyma. This is xerophytic feature. The veins are surrounded by a sheat of paranchymatous cells. Under the mesophyll is lower epidermis. Stomata occur only on lower surface of the leaf. In transverse sections, it is seen that, on upper surface there is no stoma, and on lower surface there is diasitic type stoma (Figure 14a; 14c; 14d).

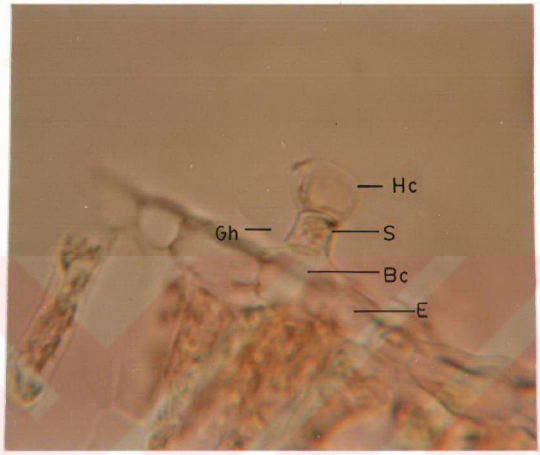

Figure 14b: Glandular hair in the cross section of the leaf of **S. albiflora** Hub.-Mor. (1250X)

Gh- Glandular hair; Hc- Head cell; S- Stalk; Bc- Base cell; E- Epidermis

Figure 14c: Upper epidermis in the transverse section of the leaf of **S. albiflora** Hub.-Mor. (1250X)
E- Epidermis cell; Hb- Hair base

Figure 14d: Lower epidermis in the transverse section of the leaf of **S. albiflora** Hub.-Mor. (1250X)

Di- Diasitic stoma

Pollen: The pollen grains of **S. albiflora** Hub.-Mor. are tri-colporate in shape and their size is about 100 micron (Figure 15).

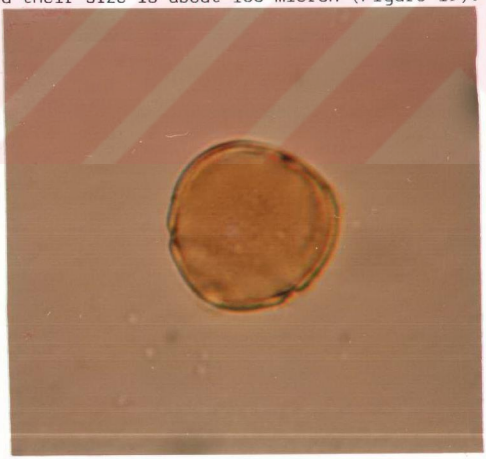

Figure 15: The pollen grain of **S. albiflora** Hub.-Mor. (1250X)

3. 2. 3. Anatomical Characteristics of S. phrygia Bornm.

Root: In the cross section of the root the following layers can be distinguished: The outer layer of the root is peridermis. Inside the peridermis is the layer of cortex, which consist of cell in 2 or 3 rows. Just below the cortex vascular bundles which consist of xylem and phloem can be seen. They cover a large area. In the middle, pith can be seen. Between the xylem and phloem tissues cambium can be seen in the form of crushed layer. Xylem which covers a large area, composed of trachea and tracheids, and sclerenchymatous cells can be seen in heaps. Pith rays consist of cells in 2 or 3 rows. We were not able to find endodermis and pericycle (Figure 16).

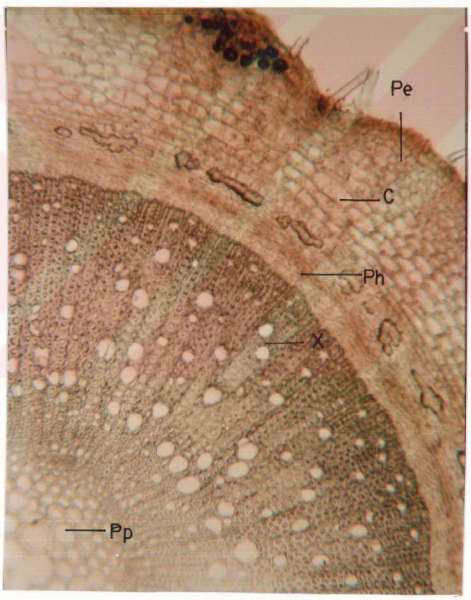

Figure 16: The cross section of the root of **S. phrygia** Bornm. (25X)
Pe- Periderm; C- Cortex; Ph- Phloem; X- Xylem;
Pp- Paranchymatous pith

Stem: This species, also, typically has four corners which characterized the family **Lamiaceae**. In the cross section of the stem following layers can be distinguished: The outer layer of the stem is a thin epidermis which covered by a waxy, transparent layer which is called cuticle. Too many glandular and nonglandular hairs emerge from epidermis (Figure 17a; 17b). The hairs' characteristics resemble the leaves. Collenchyma layers which contain thick walled cells can be seen on the corners of the stem. A layer of chlorenchyma which is composed of loosely-packed cells containing chlorophyll is placed inside the epidermis. Endodermis which contains circle shaped large cells is just below the chlorenchyma. Inside of the endodermis is a layer which is composed of sclerenchymatous cells. In vascular bundles of the stem there is an outer region known as phloem and an inner one called xylem. A layer of dividing cells are called cambium which separates the phloem from the xylem. In the xylem tracheas, tracheids and less numerous sclerenchymatous cells which are seen in heaps, are found. The pith contains spherical paranchymatous cells, and it covers a large area. Parachymatous cells in pith become smaller towards xylem and the wall of its cells becomes thick. Pith rays consist of cells in 2 or 3 rows. We were not able to see stomata in the stem

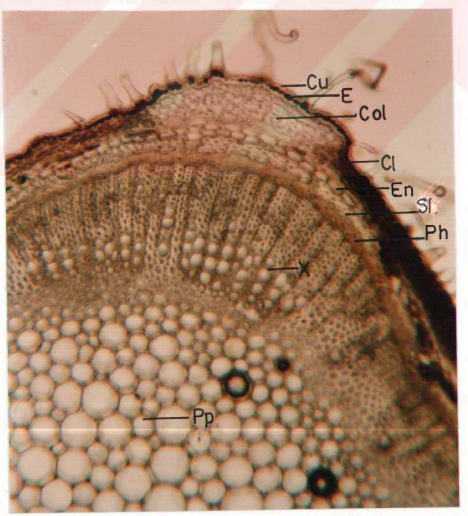

Figure 17a: The cross section of the stem of **S. phrygia** Bornm. (25X)

Cu- Cuticle; E- Epidermis; Cl- Chlorenchyma layer;
Col- Collenchyma; En- Endodermis; Sl-Sclerenchymatous layer;
Ph- Phloem; X- Xylem; Pp- Paranchymatous pith

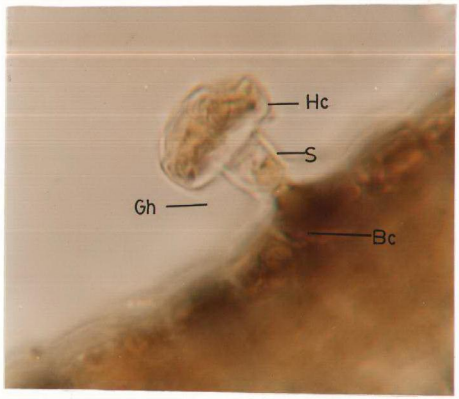

Figure 17b: Glandular hairs in the cross section of the stem of **S. phrygia** Bornm. (1250X)
Gh- Glandular hair; Hc- Head cell; S- Stalk; Bc- Base cell

Leaf: The following layer can be distinguished in the cross section of the leaf; The upper and the lower surfaces of the leaf are surrounded by a layer called epidermis. The upper epidermis consists of a single layer of cells. Epidermis cells are more or less rectangular and they do not have chlorophyll. Cells of upper epidermis are larger than lower ones. Too many glandular and nonglandular hairs emerge from both surfaces of the epidermis (Figure 18a; 18b). Many nonglandular hairs have 1, 2 or 3 cells. Unicellular hairs are both short and long. The hairs are longer on upper surface of the leaf. Multicellular hairs are 4-5 times longer than unicellular hairs. Glandular hairs have multicellular head and long stalk, and have unicellular head and short or long stalk. Glandular hairs have unicellular heads, and stalks which are longer than 3 head cells characterize the **Sideritis** L. genus (Metchalfe, 1950). The upper epidermis is covered by a waxy, transparent layer called cuticle. Just below the upper epidermis, the mesophyll which consists of cells containing numerous chloroplast can be seen. The mesophyll is divided into two layers; the upper is palisade layer in which the cells are cylindrical and situated side by side, with their longer sides at right angles to the leaf, and the lower is spongy layer whose cells are irregular in shape and loosely packed together. The spongy cells are rounded, thin walled, and also have chlorophyll. Another palisade

layer can be seen again under the spongy layer. The air spaces are large, and have irregular cavities among the spongy cells. They are connected with each other and open through the upper and lower epidermis by the way of the stomata. The veins containing xylem and phloem tubes and fibres are scattered through the spongy layer. They are accompanied by sclerenchyma. This is xerophytic feature. The veins are surrounded by a sheat of parenchymatous cells. Under the mesophyll is the lower epidermis. Stomata occur on both surfaces. They are typically jut out from epidermis. In transverse sections, it is seen that, stomata are diasitic type.

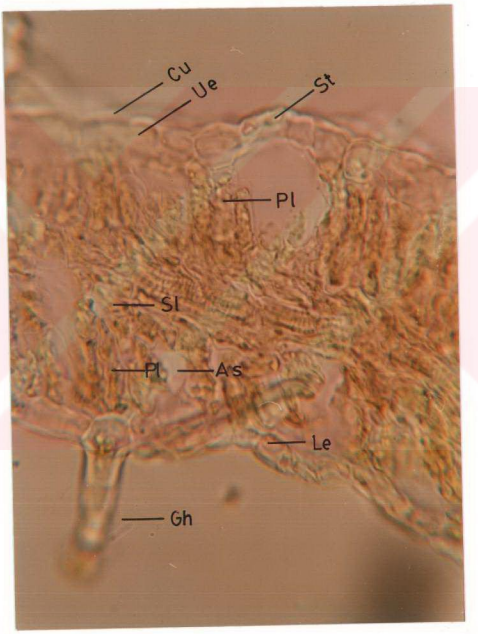

Figure 18a: The cross section of the leaf of **S. phrygia** Bornm.

Cu- Cuticle; Ue- Upper epidermis; St- Stoma;
Pl- Palisade layer; Sl- Spongy layer; As- Air spaces;
Le- Lower epidermis; Gh- Glandular hair

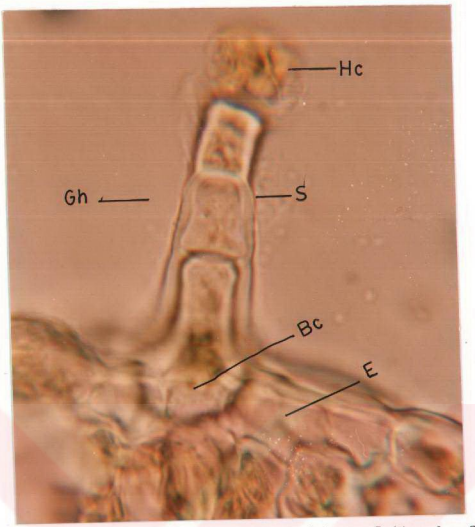

Figure 18b: Glandular hair in the cross section of the leaf of **S. phrygia** Bornm. (1250X)

Gh- Glandular hair; Hc- Head cell; S- Stalk;
Bc- Base cell; E- Epidermis

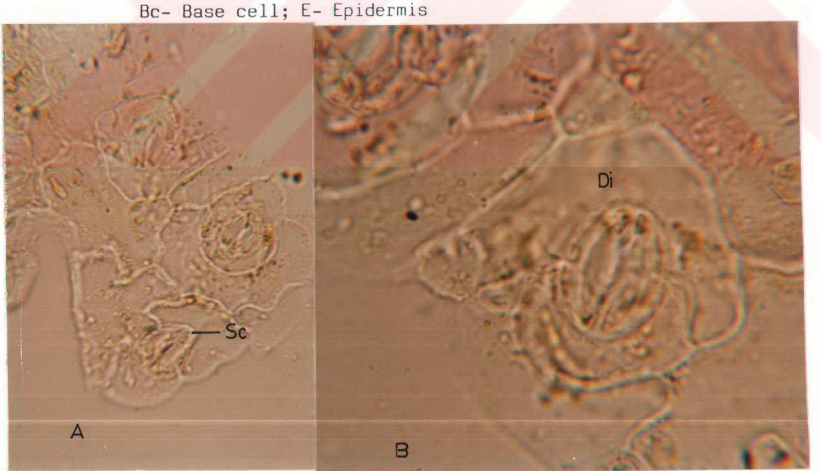

Figure 18c: Upper epidermis in the transverse section of the leaf of **S. phrygia** Bornm. (A- 260X; B- 1250X)

Sc- Stoma cell; Di- Diasitic stoma

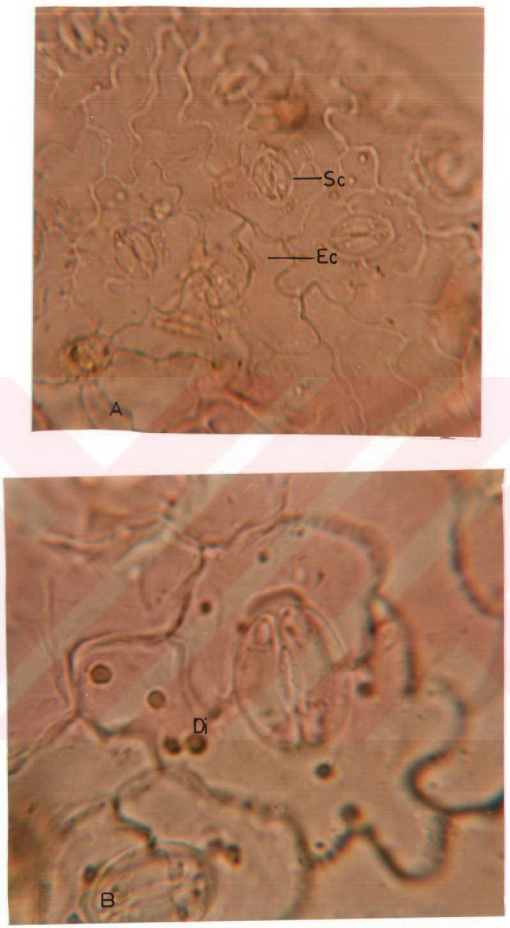

Figure 18d: Lower epidermis in the transverse section of the leaf of **S. phrygia** Bornm. (A, 260X; B- 1250X)

Sc- Stoma cell; Di- Diasitic stoma; Ec- Epidermis cell

Pollen: The pollen grains of **S. phrygia** Bornm. are tri-colporate in shape and their size is about 100 micron (Figure 19).

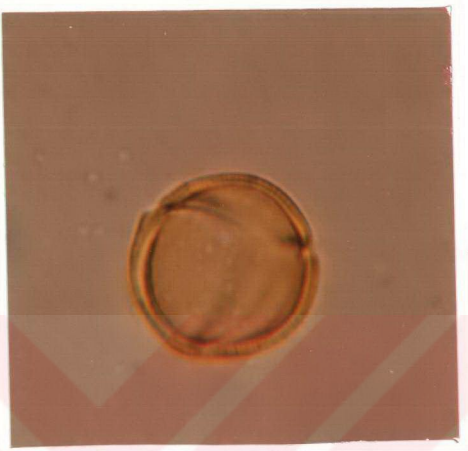

Figure 19: The pollen grain of **S. phrygia** Bornm. (1250X).

3. 3. Results of Cytotaxonomy of Observed Endemic Sideritis L. Species

3. 3. 1. S. leptoclada O. Schwarz & P. H. Davis

In the cytological researches on root epidermis cells of **S. leptoclada** O. Schwarz & P. H. Davis, chromosome number was counted as 2n=32 (Figure 20). In the studies, it was observed that chromosomes of this species were small (about 1,5 micron) and about metacentric in shape.

3. 3. 2. S. albiflora Hub.-Mor.

In the cytological researches on root epidermis cells of **S. albiflora** Hub.-Mor. , chromosome number was counted as 2n=32 (Figure 21). In the studies, it was observed that chromosomes of this species were small (about 1,0-1,2 micron) and about metacentric in shape.

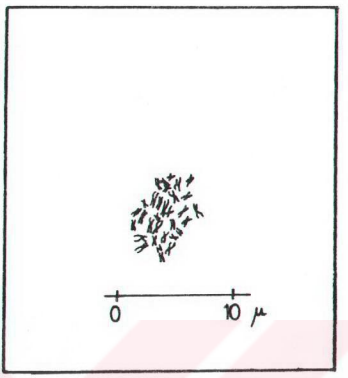

Figure 20: Metaphase stage of mitotic division in the root epidermis cells of **S. leptoclada** O. Schwarz & P. H. Davis (2n=32)

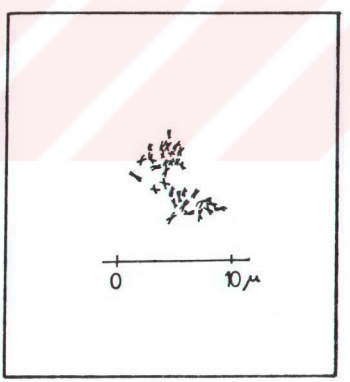

Figure 21: Metaphase stage of mitotic division in the root epidermis cells of **S. albiflora** Hub.-Mor. (2n=32)

3. 3. 3. S. phrygia Bornm.

In the cytological researches on root epidermis cells of **S. phrygia** Bornm. , chromosome number was counted as 2n=32 (Figure 22). In the studies, it was observed that chromosomes of this species also were small (about 1,0-1,5 micron) and about metacentric in shape.

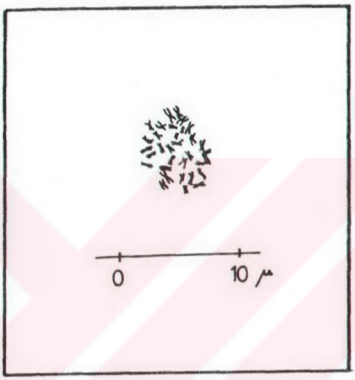

Figure 22: Metaphase stage of mitotic division in the root epidermis cells of **S. phrygia** Bornm. (2n=32)

4. DISCUSSION

In this research, anatomical, morphological and cytotaxonomical characteristics of **S. leptoclada** O. Schwarz & P. H. Davis, **S. albiflora** Hub.-Mor. and **S. phrygia** Bornm. species distributed in West Anatolia were observed. Obtained results which belong to these 3 endemic species can be summarized as follows:

a- Morphological Characteristics of Observed Endemic Sideritis L. Species;

Fresh materials of **S. leptoclada** O. Schwarz & P. H. Davis and **S. albiflora** Hub.-Mor. species were collected by us, and fresh materials of **S. phrygia** Bornm. were collected in accordance with a cooperative project by Aegean Agricultural Research Institute. Morphological characteristics of the fresh materials and herbarium samples were fixed, and they were compared with the book of "Flora of Turkey and East Aegean Islands" by P. H. Davis. Samples which belong to the collected species were compared with samples which belong to Ege University Herbarium Center, Selçuk University Herbarium Center, Ankara University Herbarium Center and İstanbul University Medicinal Faculty Herbarium Center. Findings of morphological characteristics of the observed species show differences in some way from the releated literature. These differences can be summarized as follows;

In **S. leptoclada** O. Schwarz & P. H. Davis;

Length of the plant is recorded as 20-60 cm in the literature, but it was fixed as 20-95 cm in our measurements; verticillaster number is recorded as 4-8 in the literature, but it was fixed as 3-10 in our findings; internodes between the verticillasters are recorded as 1-5 cm in the literature, but it was fixed as 1-6 cm in our measurements; length of the calyx teeth is recorded as 2,0-2,5 mm in the literature, but it was fixed as 2,0-2,8 mm in our measurements. Biometric measurements of the leaves paired numbers, internodes between the leaves, the bract width, acumen length of the bract, the seed width and length were given in original.

In **S. albiflora** Hub.-Mor.

Length of the plant is recorded as 50-60 cm in the literature, but it was fixed as 50-85 cm in our measurements; bract width is recorded as 1,0-1,5 cm in the literature, but it was fixed as 0,9-1,5 cm in our measurements. Biometric measurements of the leaves paired numbers, internodes between the leaves, the seed width and length were given as orginally.

In **S. phrygia** Bornm.

Length of the plant is recorded as 20-50 cm in the literature, but it was fixed as 20-65 cm in our measurements; middle leaves length is recorded as (2)-4-6 cm in the literature, but it was fixed as 3-9 cm in our measurements; bract length is recorded as 1,0-1,5 cm in the literature, but it was fixed as 1,0-1,8 cm in our measurements; bract width is recorded as 0,8-1,0 cm in the literature, but it was fixed as 0,8-1,8 cm in our measurements; calyx length is recorded as 8-10 cm in the literature, but it was fixed as 8-10,5 cm in our measurements; length of the calyx teeth are recorded as 3,0-3,5 mm in the literature, but they were fixed as 3-4 mm in our measurements; corolla length is recorded as 12-13 mm in the literature, but it was fixed as 12-14 mm in our measurements. Biometric measurements of the seed width and length were given as originally.

It is seen that, in the characters which are given by P. H. Davis as determination key some differences with our findings were found. The reason of these differences were that perhaps P. H. Davis did not study with sufficient research materials. For these reasons, in order not to cause any mistake and to find stronger criteria for the key, we tried to study with much amount of samples in our studies. According to the results our researches, following obtained characteristics, which are the length of the plant, middle leaves length, width and internodes, verticillaster numbers, internodes, flower numbers of each verticillasters, the bract length and width and sometimes acumen length, calyx length, teeth shape and length, corolla color and length, in our opinion, can be useful criteria for the key of **Sideritis** L. species Empedoclea section.

b- Anatomical Characteristics of Observed Endemic Sideritis L. Species

3 endemic **Sideritis** L. species included in our research subject were observed anatomically for the first time. METCHALFE (1957) has given general knowledges of **Sideritis** L. genus on genus level. In species level he has not given any knowledge. Anatomical studies were done by SEZİK and EZER (1983-1988) on **S. congesta** and **S. arguta**, and UYSAL (1991) on **S. trojana**. But we were not able to find any other anatomical research on **S. leptoclada, S. albiflora** and **S. phrygia**.

Because of **Sideritis** L. species is perennial and has woody root, the outer layer of the root, peridermis can be seen. On the other hand, in **S.albiflora** Hub.-Mor. widen xylem which covers pith is present. In the anatomy of the stem collenchymatous cells are seen on the corners. This is characteristic for **Lamiaceae** family (Metchalfe, 1950). This structure was recorded on **S. congesta** & **S. arguta** (Sezik, 1983; Ezer,1988), and **S. trojana** (Uysal, 1991) endemic species. Epidermis is covered by a thick cuticle. Many glandular and nonglandular hairs derive from epidermis. The hairs' characteristics resemble the leaves. We were not able to find stomata in the stem. Chlorenchyma is seen in the stem cortex. Chlorenchyma was not recorded on **S. congesta** & **S. arguta** (Sezik, 1983; Ezer, 1988), but was recorded on **S. trojana** (Uysal, 1991). The leaf is ecvifasial on **S. leptoclada** O. Schwarz & P. H. Davis and **S. phrygia** Bornm. , bifasial on **S. albiflora** Hub.-Mor. , and they are covered by a thick cuticle. It is recorded that, the leaf is bifasial and covered by a thin cuticle on **S. congesta** & **S. arguta** (Sezik, 1983; Ezer, 1988), and ecvifasial and covered by a thick cuticle on **S. trojana**. Cells of upper epidermis are longer than lower ones. Too many glandular and nonglandular hairs emerge from both surfaces of the leaves. In glandular hairs, stalks are longer than 3 head cells. This is characteristic for **Sideritis** L. genus, according to Metchalfe and Chalk. The leaf is amphistomatic on **S. leptoclada** O. Schwarz & P. H. Davis and **S. phrygia** Bornm., and hypostomatic on **S. albiflora** Hub.-Mor. It is recorded that, **S. congesta** & **S. arguta** have hypostomatic leaves (Sezik, 1983; Ezer, 1988), and **S. trojana** has amphistomatic leaves (Uysal, 1991). Spongy paranchyma is rather reduced in the leaf' mesophyll. This is characterized xeromorph plants. The vascular veins in the leaf are surrounded by a sheat of paranchymatous cells. This is a typical characteristic.

According to obtained data, there is no record releated to pollen anatomy of the genus. First of all, we studied on the pollen anatomy of the genus, that means, of the observed 3 endemic species.

We were not able to find detailed anatomical studies on the species of **Sideritis** L. genus in our literature researches. Therefore, we were not able to reach a conclusion in using or not using of the anatomical results in determination key. It is no doubt that,many new anatomical findings can appear, in detailed anatomical researches.

c- Cytotaxonomical Characteristics of Observed Endemic Sideritis L. Species

DARLINGTON (1955), LÖVE (1952), FEDEROV (1969), STRID (1965), and CONTANDRIOPOULOS (1978) named researchers have studied on some species of **Sideritis** L. genus distributed in Europe and Turkey, and they have fixed their chromosome numbers. But we were not able to find any record on observed 3 endemic species. Therefore, chromosome countings of these 3 endemic **Sideritis** L. species distributed in West Anatolia were done by us. Chromosome numbers of each species of **S. leptoclada** O. Schwarz & P. H. Davis, **S. albiflora** Hub.-Mor., and **S. phrygia** Bornm. were fixed as 2n=32. According to DARLINGTON (1955), the main chromosome number of **Sideritis** L. genus is indefinite. He has fixed the chromosome numbers of some **Sideritis** L. species of South Europe as 2n=22, 28, 30, 32. LÖVE (1952) has found the chromosome number as 2n=32, in his studies of Middle European **Sideritis** L. species. FEDEROV (1969) has reported that, the chromosome number of the genus as 2n=30. STRID (1965) and CONTANDRIOPOULOS (1978) has observed the chromosomes of 8 **Sideritis** L. species distributed in South Anatolia, and they have fixed the chromosome numbers of the species as 2n=28, 32 and34. It is seen that, in our studies the main chromosome number is fitting. It is understood that, in the studies, observed 3 endemic species have small and the metacentric type chromosomes. ROHWEDER (1934) has reported that, in his researches on **Dianthus** species, species which contain large chromosomes are more developed than species containing small chromosomes. On the other hand, STEBBINS (1971), LEVAN (1964) and ISING (1970) have reported that, species which have metacentric chromosomes and homojen caryotypes belong to old flora; species which have heterojen caryotypes belong to new flora. It is known

that, species belonging old flora, except some exceptions (e.g. **Pinus** sp.), could exist up to now by increasing their ploidi level. According to literature data, it is understood that, these 3 endemic **Sideritis** L. species have strengthly possible primitive features.

Our country is covered by too many natural plants. Many of them distribute only in Turkey, that means, these are endemic plants. As there are few studies on the chromosome number of the species, it is a deficiency and it is necessary to make chromosome atlas of them. Besides them, fixation of chromosome number of the endemic species will be useful for making revision of problem species of our flora. And this can contribute to floristic researches in our country.

It was fixed that, the following examined 3 endemic **Sideritis** L. species, that is, **S. leptoclada** O. Schwarz & P. H. Davis is used as tea and folk medicine around Muğla; Marmaris, Köyceğiz and Dalaman, under the name of "Kızlan" and around Denizli; Beyağaç (Eskere), under the name of "Kırtıl"; **S. albiflora** Hub.-Mor. is used as tea and folk medicine around Muğla; Marmaris, Köyceğiz and Dalaman, under the name of "Bozlan"; and **S. phrygia** Bornm. is used as tea and folk medicine around Afyon; Çay, under the name of "Çayotu".

It is also understood from the literature data that, **Sideritis** L species can be used as anantimicrobial substance due to their effective substances (Villar, 1985b). But these species having economical value are unconciously uprooted for a purpose of selling,and also are being grazed by animals. According to Red Data Book Categories, it is necessary to protect these 3 endemic **Sideritis** L. species are in the "Rare" category, against extinction and if they are used as row material source take them into cultivation. We do not only believe that it is useful to investigate these species which expand throughout country, but also to investigate other species from this point of view.

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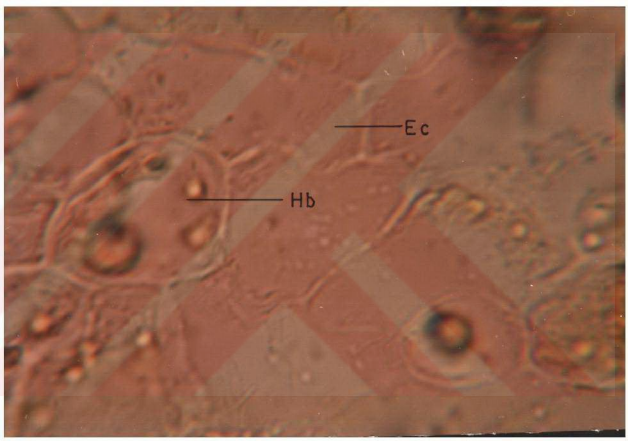
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