Pak. J. Bot., 38(1): 67-83, 2006.

A MORPHOLOGICAL INVESTIGATION ON *SILENE* L., (*CARYOPHYLLACEAE*) SPECIES DISTRIBUTED IN WEST ANATOLIA AND NORTH CYPRUS

KEMAL YILDIZ

Department of Biology, Faculty of Science and Letters,
Celal Bayar University, 45140 Muradiye- Manisa, Turkey.
**E-mail: kemalyil@gmail.com*

Abstract

In this study, the morphology of *Silene sipylea* (L.) O. Schwarz, *S. fabaria* (L.) Sibth. & Sm., *S. tenuiflora* Guss., *S. lydia* Boiss. distributed in West Anatolia (B1, C1, C2) and *S. discolor* Sibth.& Sm., *S. colorata* Poir. var. *colorata*, *S. apetala* Willd. var. *grandiflora* distributed in North Cyprus was investigated. Making use of fresh specimens collected from both geographical regions, drawings of the general view and parts of the plant such as the flower, parts of the flower (sepal, petal), fruit were made, and micrographs of the seeds taken by stereo light microscopy. Significant morphological and seed characters related to the species are presented.

Longest calyx was encountered in *S. sipylea* and the shortest in *S. apetala* var. grandiflora while *S. lydia, S. discolor*, *S. colorata* var. *colorata* and *S. apetala* var. grandiflora had puberulent calyx, *S. sipylea*, *S. fabaria* and *S. tenuiflora* had a glabrous calyx. *S. fabaria*, *S. tenuiflora* and *S. apetala* var. *grandiflora* were found to have 10 anastomotic veins in the calyx, whereas *S. discolor*, *S. colorata* var. *colorata* and *S. sipylea* had 10, and *S. lydia* 25-30 in the calyx. Ligula were observed in the basal petal blades of all the species. Ligula of *S. sipylea* and *S. lydia* are quite small. The anthophore in *S. lydia* is approximately 1 mm and as long as 25-30 mm in *S. sipylea* The seeds of *S. colorata* var. *colorata* and *S. apetala* var. *grandiflora* are distinct from those of the other species, they are reniform shaped, round, winged and wrinkled. The largest seeds were observed in *S. tenuiflora* and the smallest in *S. discolor*. The tubercles are quite distinct in *S. lydia* and *S. tenuiflora* has an elongated conical shape.

Introduction

In this study, the morphology of *Silene sipylea* (endemic to Turkey), *S. fabaria*, *S. tenuiflora*, *S. lydia*, *S. discolor*, *S. colorata* var.*colorata* and *S. apetala* var. *grandiflora*, distributed in West Anatolia and North Cyprus was investigated.

Silene is represented with about 170 taxa in the Flora of Turkey and with about 20 taxa in the Flora of North Cyprus (Davis, 1967, 1988; Güner *et al*., 2001; Meikle, 1977; Viney, 1994).

There are no studies on the *Silene* species of North Cyprus except for Yıldız & Gücel (2003) cytotaxonomical and palynological study on North Cyprus endemics and on *Silene gigantae* L. var. *gigantea* and *S. behen* L. distributed in North Cyprus and West Anatolia. A number of taxonomical observations related to *Silene* species in some floristic studies have been made (Meikle 1977; Viney 1994). As for the taxonomical and morphological studies conducted on the *Silene* species distributed in Turkey and surrounding geographical regions outside North Cyprus, one can encounter Melzheimer's (1977) biosystematic revision of the *Silene* taxa distributed in the Balkans. In this study, a comparative examination of seed, calyx and petal characters as well as pollen characteristics was made. In another study in which he discussed the taxonomical

position of *Silene thebana* Orph.ex Boiss. distributed in Greece, Melzheimer (1987) made use of the morphology of leaf, petal and seed as the most distinctive criterion. Prentice (1978, 1979, 1980, 1988) examined the taxonomical and karyological diagnostics of the *Silene* species belonging to section *Elisanthe*. Authier (1992) made morhological examinations on *Silene remotiflora* Vis. species distributed in Northwest Greece. Greuter (1995), classified the *Silene* species available in Greece. In this study systematic characters of the sections were reviewed and the phylogenetic relationships of the genus among species investigated. Desfeux ve Lejeune (1996), made a phylogenetic analysis of 22 species of the European-Mediterranean *Silene* species. In a study on *Silene cserei* Baumg. subsp. *aeoniopsis* (Bornm.) Chowdh., which is an endemic taxon, and *Silene vulgaris,* showed quite similar characteristics Vural and Adıgüzel (1996).

Yıldız & Çırpıcı (1992) investigated the morphology of 8 *Silene* species disributed in Tokat province (A5-A6) and its environs. Yıldız & Çırpıcı (1998) also determined the seed morphology of a total of 19 *Silene* species disributed in Turkey, 3 of which are endemic, using stereo and scanning electron microscopy (SEM). Yıldız (2002) also studied the seed morphology of 17 *Caryophyllaceae* species distributed in North Turkey including *Dianthus* and *Silene* species. No detailed morphological studies have been made. The objective of the present study was to determine the morphological characteristics of the *Silene* species growing in West Anatolia and North Cyprus, and to discuss the systematic position of the species that belong in the same section according to these characteristics. The classification of the species studied was made accoding to the Flora of Turkey (Davis, 1967) and the Flora of Cyprus (Meikle, 1977).

Materials and Methods

Specimens of the *Silene* species were collected from West Anatolia (B1, C1, C2) and North Cyprus between the years 2001 and 2003 (Table 1, Fig. 1). Information was gathered from various floristic works covering the investigation area and immediate surroundings (Meikle, 1977; Viney, 1994; Davis 1967, 1988; Güner *et al*., 2001) and two herbariums [Ege University Faculty of Sciences Herbarium (EGE), North Cyprus Herbarium].

An average of 6-7 specimens belonging to each species were collected from each locality. Some of the specimens were put into 70% alcohol to be used in morphological studies. Tthe plant specimens collected from investigation area were identified after reference to Flora of Turkey and East Eagean Islands (Davis, 1967), Flora of Cyprus (Meikle, 1977) along with An Illustrated Flora of North Cyprus (Viney, 1994). Moreover, the plants were identified and checked in Ege University Faculty of Science Herbarium (EGE) and North Cyprus Herbarium.

In the morphological study, *Silene* species collected from West Anatolia and North Cyprus, the diagnostic features such as plant height, arrangement of the basal and cauline leaves, inflororescence, sepal, petal and fruit are given in table form.

Moreover, drawings of 7 plants belonging to 7 species showing the general view and parts such as the calyx (sepal), petal and fruit were included in the study (Figs. 2-8). The specimens collected were deposited in the Department of Biology, Celal Bayar University, Turkey. The plants were given numbers starting with the letter ‘K’, as an abbreviation for K.YILDIZ. A map of the investigation area where the specimens were collected was also added to the study.

Table 1. Data for the collection of *Silene* species (B, C: Squares of Flora of Turkey).

Species	Locality, date, number
Silene sipylea (West Anatolia) Endemic for Turkey	B1 Manisa, Sipil mountain, near road, slopes, 800-900 m, 05.06.2002, K060.
S. fabaria (West Anatolia)	C2 Muğla, between Sultaniye-Kaunas, 200-300m, 08.05.2003, K063.
S. tenuiflora (West Anatolia)	C1 Muğla, 40 km from Marmaris to Datça, rocky places, 300-400m, 20.07.2003, K070.
S.lydia (West Anatolia)	1.B1 Manisa, Sipil mountain, near road, slopes, rocky places, 500-600m, 14.05.2003, K067. 2. B1 Manisa, Sipil mountain, near lake, 900-1000m, 14.05.2003, K066.
S. discolor (North Cyprus)	Lefkoşa (Nicosia), Alevkaya (Halevga), in forest and near road, 750-800m, 20.06.2003, K058.
S. colorata var. *colorata* (North Cyprus)	Girne (Kyrenia), Hz. Ömer shore, sea level, 20.06.2003, K069.
S. apetala var. *grandiflora* (North Cyprus)	Lefkoşa (Nicosia), Buffavento castle, rocky places, slopes, 800-900m, 23.04.2001, K055.

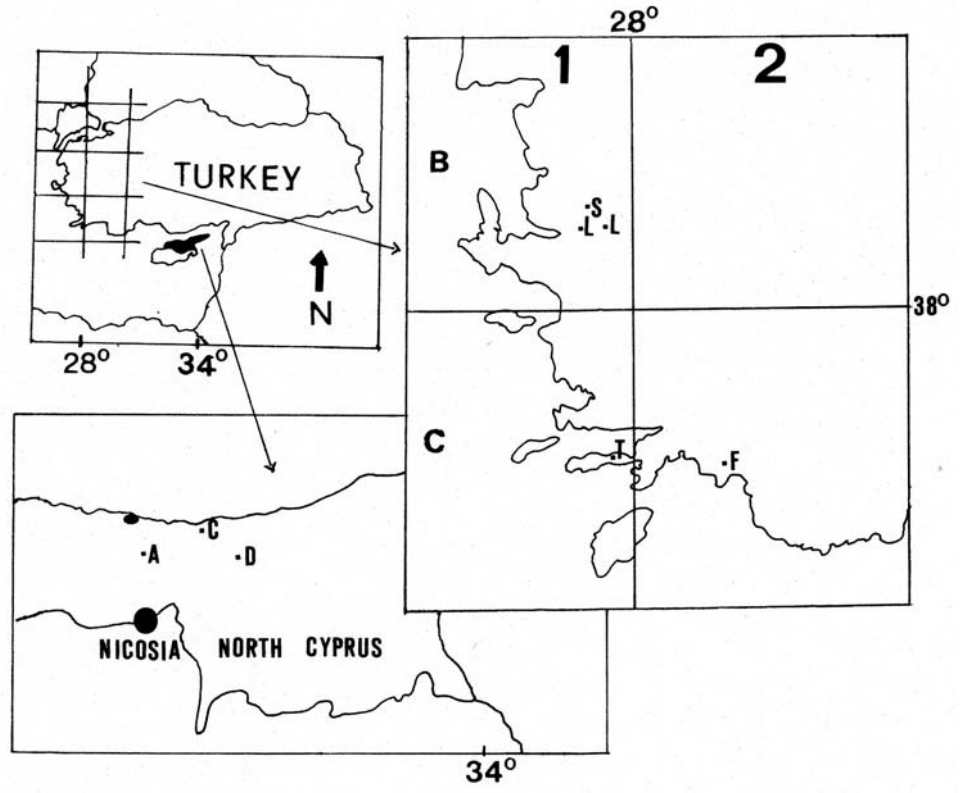

Fig. 1. Map of the investigation area (S: *Silene sipylea*, F: *S. fabaria*, T: *S.tenuiflora*, L: *S. lydia*, D: *S. discolor,* .C: *S. colorata* var. *colorata*, .A: *S. apetala* var. *grandiflora*.

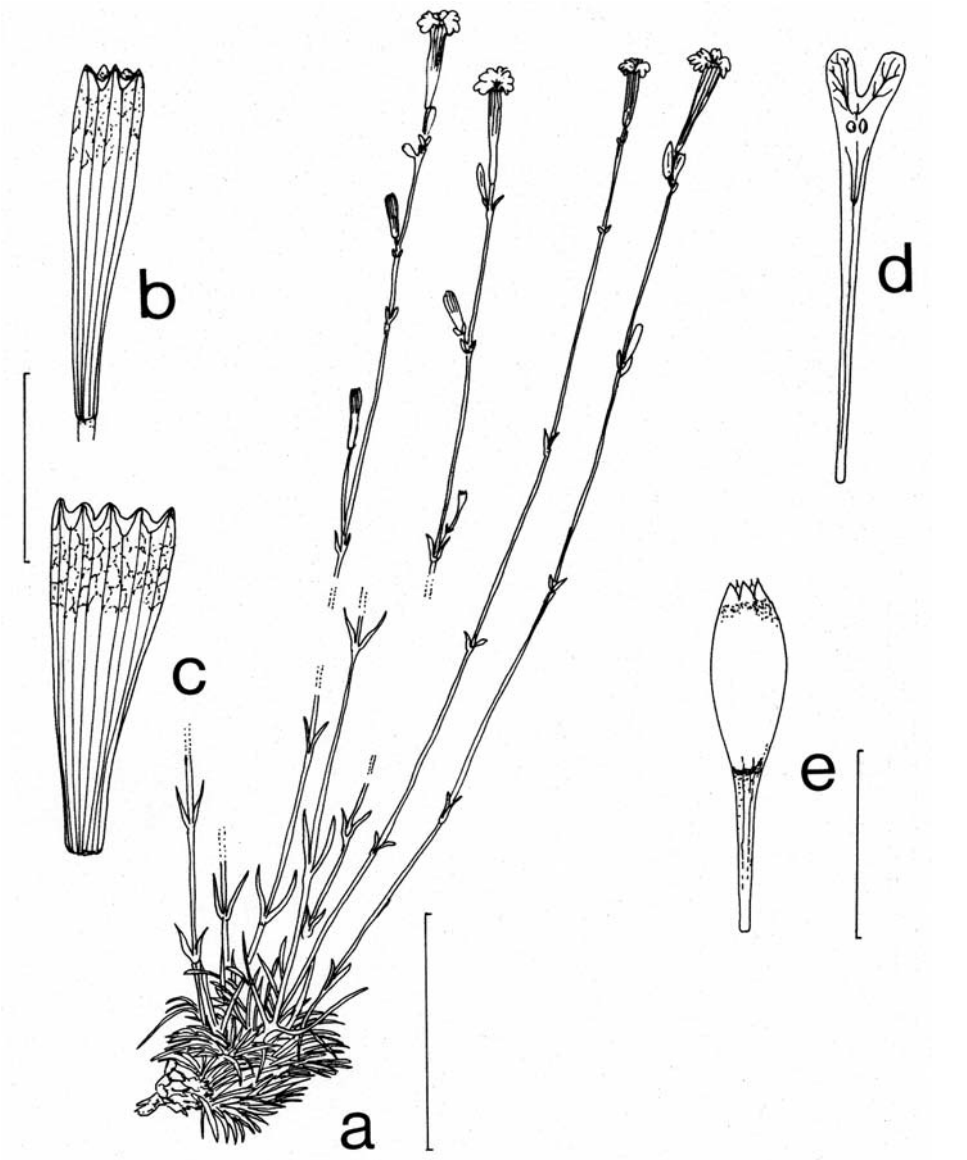

Fig. 2. *Silene sipylea*, (K060, West Anatolia) a. General wiew (——: 5cm), b. Calyx (Flower), c. Calyx (Opened), d. Petal, e. Fruit (Capsule), (b, c, d, e: ——: 20 mm).

Micrographs of the seeds were taken using an olympus WM trinocular Stereo dissection microscope (Figs. 9, 10). A NFKx3.3 LD 125 Lens was used during the examination. At least 20 seeds from each species except for the *S. sipylea* and *S. fabaria*, whose seeds could not be obtained, were examined to specify the micromorphological character of the seeds. Morphological characters of the seeds were determined according to Prentice (1978) and Stearn (1996).

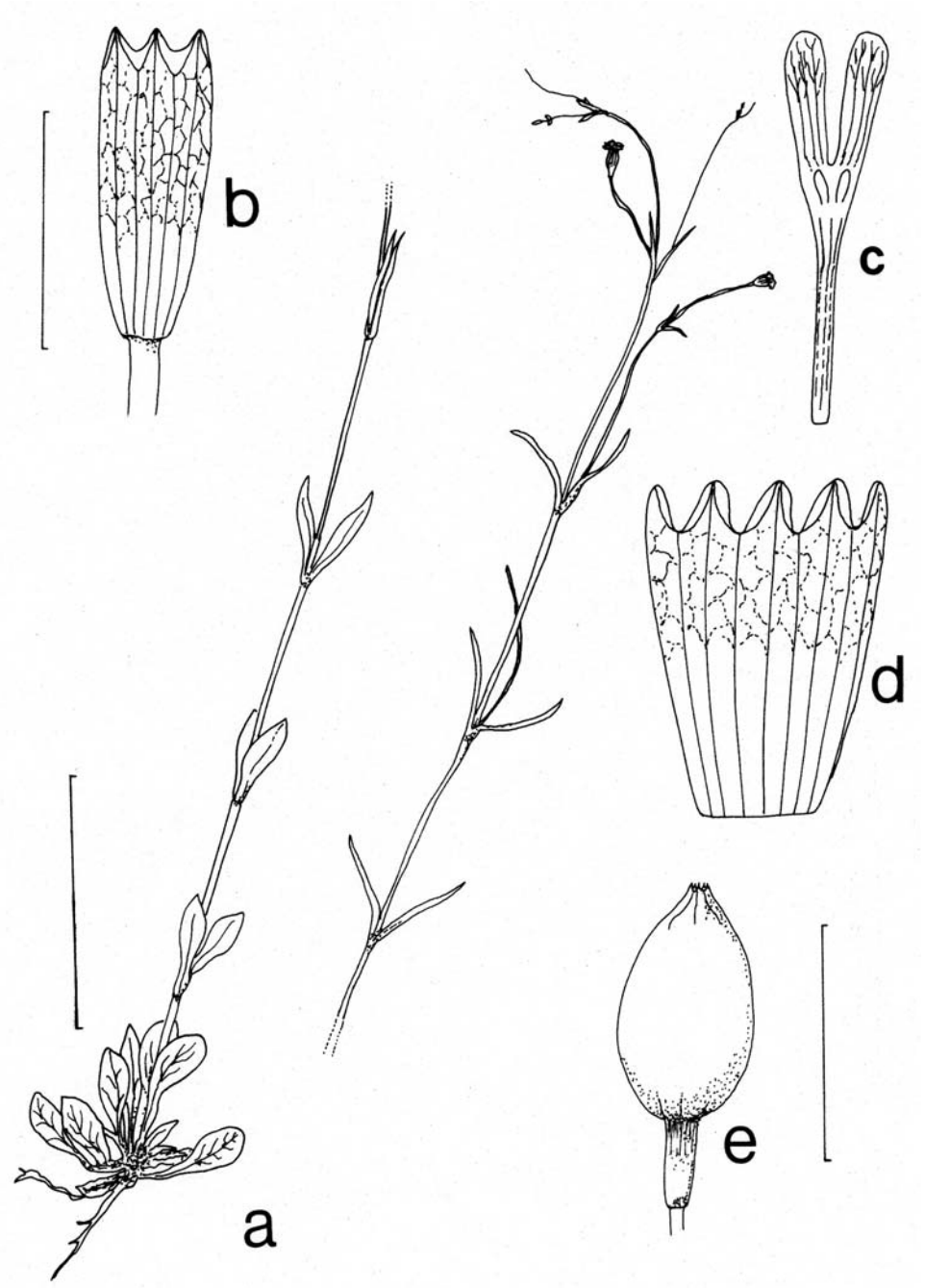

Fig. 3. *S. fabaria*, (K063, West Anatolia) a. General wiew (——: 10 cm), b. Calyx (Flower), c. Petal, d. Calyx (Opened), e. Fruit (Capsule), (b, c, d, e: ——: 10 mm).

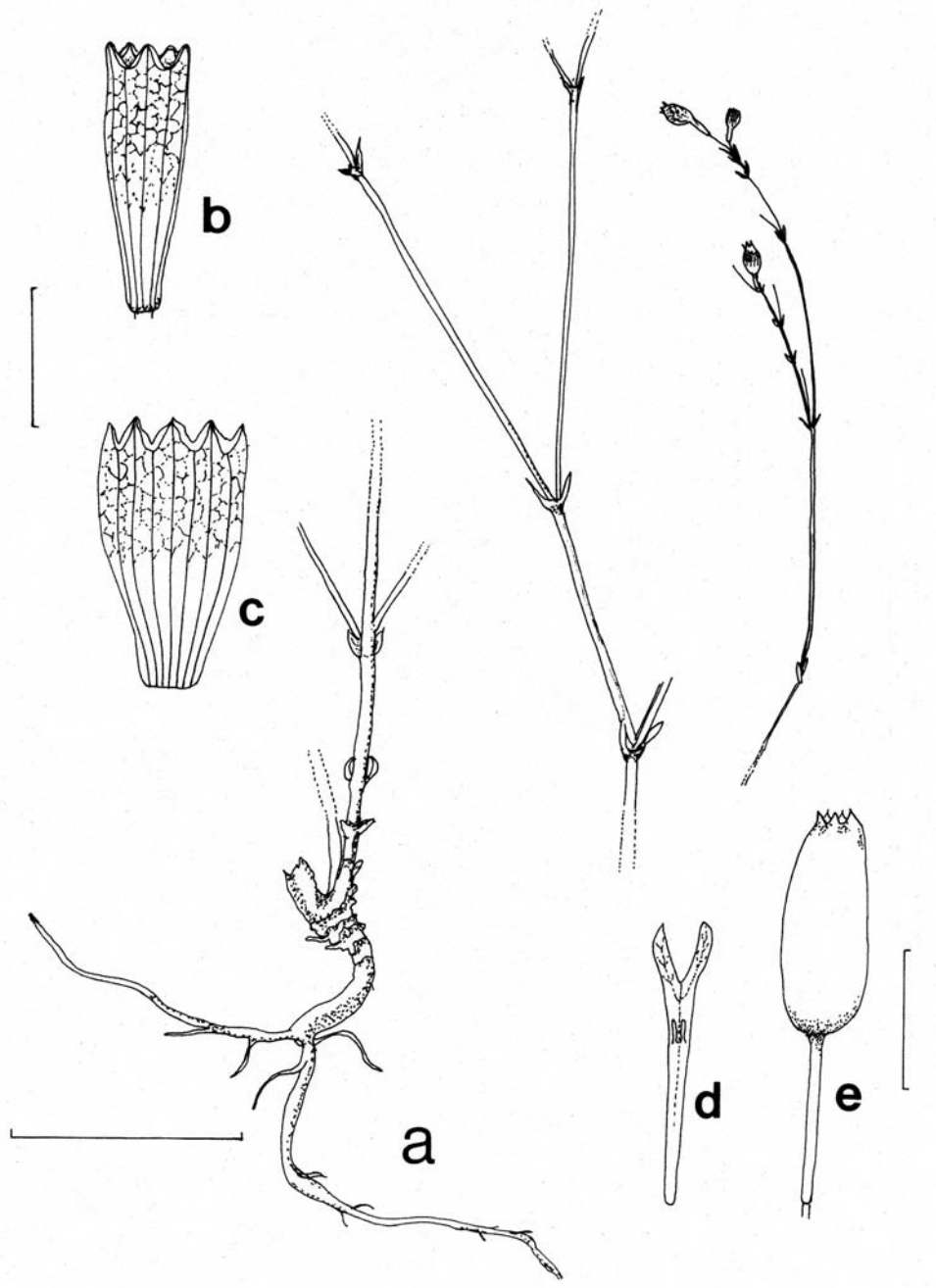

Fig. 4. *S. tenuiflora*, (K070, West Anatolia) a. General wiew (——:5cm), b. Calyx (Flower), c. Petal, d. Calyx (Opened), e. Fruit (Capsule), (b, c, d, e: ——:10 mm).

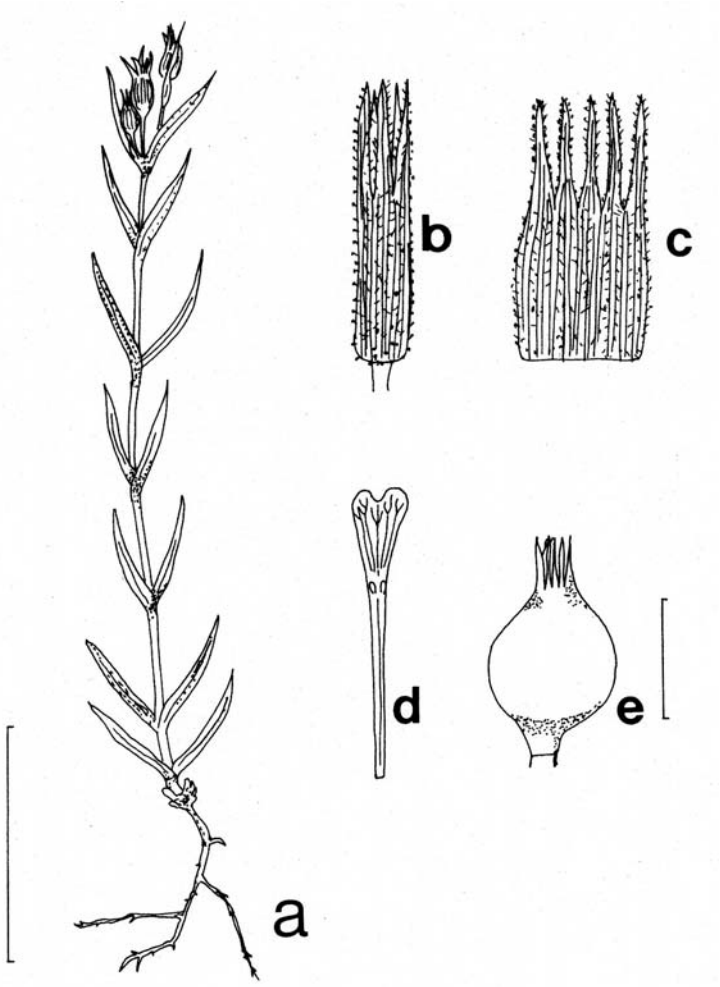

Fig. 5. *S. lydia,* , (K067, West Anatolia) a. General wiew (——:5cm), b. Calyx (Flower), c. Petal d. Calyx (Opened), e. Fruit (Capsule), (b, c, d, e: ——:10 mm).

Results and Discussion

A morphological investigation was conducted on *S. sipylea*, *S. fabaria*, *S. tenuiflora*, *S. lydia* from West Anatolia and *S. discolor*, *S. colorata* var. *colorata* and *S. apetala* var. *grandiflora* from North Cyprus, which is represented with nearly 170 taxa in the Flora of Turkey and aproximately 20 taxa in the Flora of North Cyprus. The most important morphological characters such as leaves of the plants at the base and cauline, calyx, petal, fruit and seed of *Silene* specimens from different localities were compared in the study. *S. tenuiflora* and *S. apetala* var. *grandiflora* occur in rocky areas, while *S. discolor* mainly grows on beaches at sea level. *S. lydia*, *S. sipylea*, *S. fabaria*, *S. colorata* var. *colorata* on the other hand often occur on slopes.

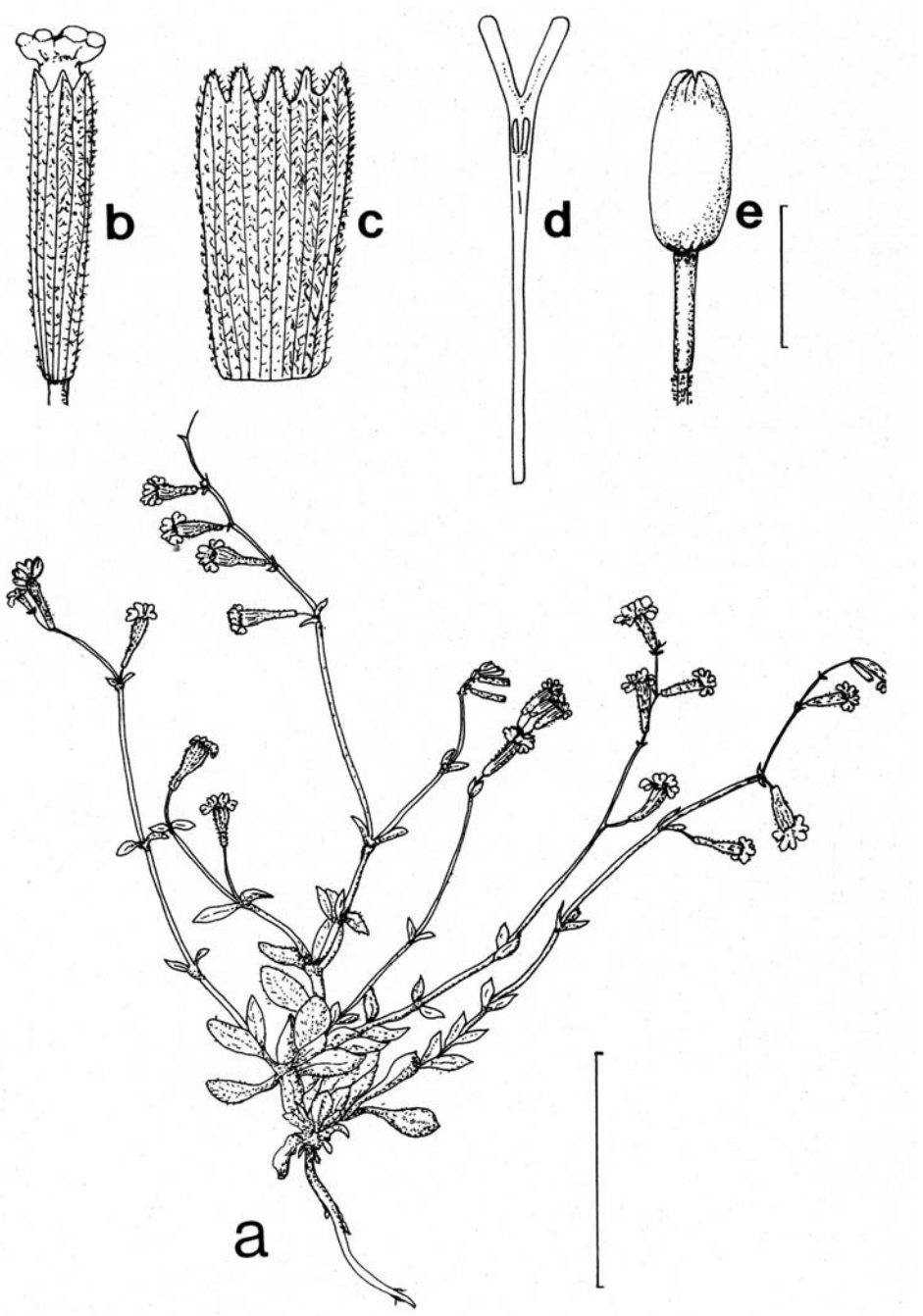

Fig. 6. *S. discolor*, (K058, North Cyprus) a. General wiew (——: 5cm), b. Calyx (Flower), c. Calyx (Opened), d. Petal, e. Fruit (Capsule), (b, c, d, e: ——: 10 mm).

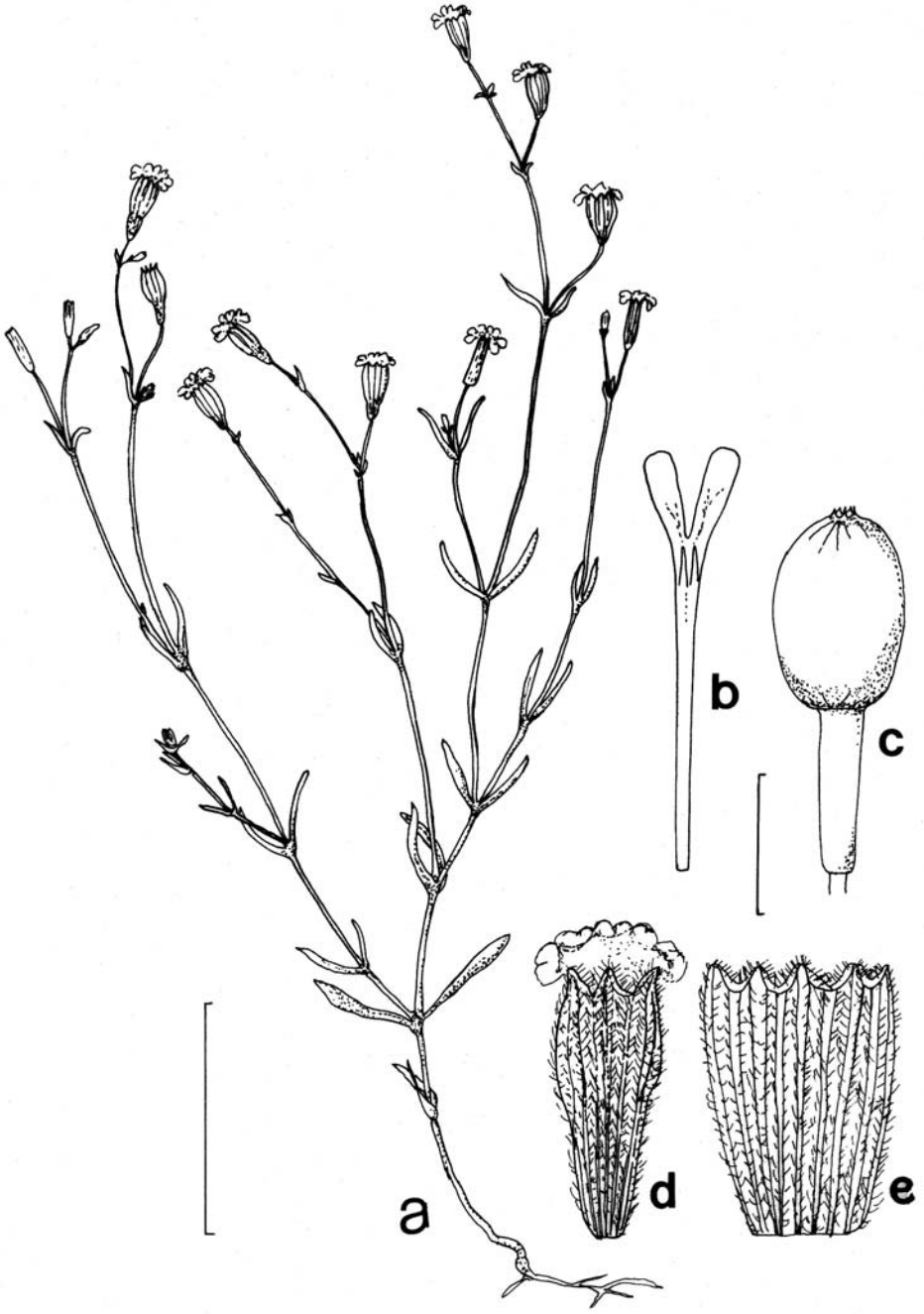

Fig. 7. *S. colorata* var.*colorata*, (K069, North Cyprus) a. General wiew (——: 5cm), b. Petal, c. Fruit (Capsule), d. Calyx (Flower), e. Calyx (Opened), (b, c, d, e: ——: 10 mm).

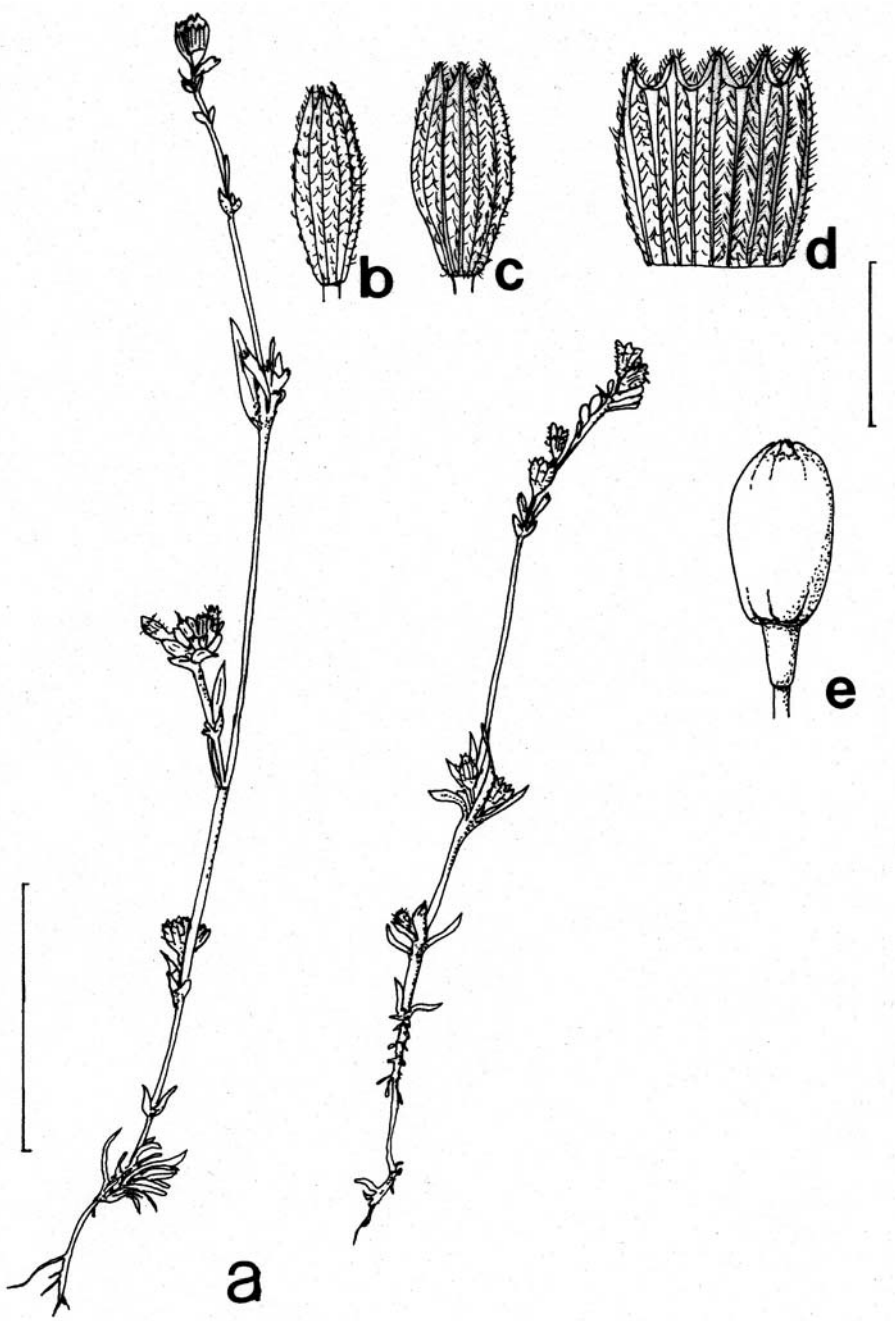

Fig. 8. *S. apetala* var.*grandiflora,* (K055, North Cyprus) a. General wiew (——: 5cm), b. Calyx (Flower), c. Calyx (on Fruit), d. Calyx (Opened), (b, c, d, e: ——: 10 mm).

Tablo 2. Diagnostic characters of *Silene* species (Figs. 2-8).

Species	*Silene sipylea* (K060, West Anatolia) Endemic to Turkey	*S. fabaria* (K063, West Anatolia)	*S. tenuiflora* (K070, West Anatolia)	*S. lydia* (K067, West Anatolia)
Height of plant (cm)	Up to 50, Perennial	90, Perennial	15-30, Annual	15-25, Annual
Basal leaves (cm)	Glabrous Narrowly oblanceolate	Glabrous, sometimes glaucous, Obovate	Oblong-Lanceolate to oblong-spatulate	Linear to Oblong
Cauline leaves	Linear, Lanceolate	Oblanceolate to Lanceolate	Gabrous, Linear	Linear to Oblong
Inflorescence	Racemose or to a single flower	A compound dichasium, often raceme-like	One flower	1-5- flowerred
Length of Calyx (cm), nerves shape and number	25-40 10 nerves	11-13 10 anastomosed nerves	12.5-15, 10 nerved, nerves hardly anastomose	13-15, 25-30 nerved
Calyx	Glabrous	Glabrous	Glabrous, litlle eglandular puberulent	Spreading hairs
Size of petal (mm)	40-50x2-3	16-17x2-3	10-11x1.5-2.5	13-14x1.5-1
Shape of petal	Bifid, Small two scales	Deply bifid, Conspicuously two scales	Limb bipartite, Like sword, two scales	Limb bipartite, Like tooth two scales
Length of Anthophore (mm)	25-30	2.5-3	1.5-3	1
Size and shape of fruit (Capsule) (mm)	Narrowly ovoid, Tooth recurved	7-10 Ovoid or ovoid globose	6-6.5x3.5-4 ovoid globose	8-10
Habitat altitude (m)	Limestone, slopes 700-800	Slopes, cliffs, 1600	Fields, rocky places 1150	Slopes, 300-1600
Flowering period	August	May-July	May	April- May

Table 2. (Cont'd.)

Species	*S. discolor* (K058, North Cyprus)	*S. colorata* var. *colorata* (K069, North Cyprus)	*S. apetala* var. *grandiflora* (K055, North Cyprus)
Height of plant (cm)	5-30, Annual	10-30 (-50), Annual	(-3) 7-30, Annual
Basal leaves (cm)	Glandular, 1-3x0.4-0.8 Obovate or Oblanceolate	glaucous, sometimes glabrous narrowly obovate or spatulate 2-5x 0.5-2	Adpressed–pubescent, narrowly oblanceolate or linear 2-5x0.3-0.5
Cauline leaves	Ovate, Lanceolate, narrowly Oblong	Oblanceolate, Linear	Very narrowly oblanceolate or linear, sessil
Inflorescence	2-6 flowered, monochasium	monochasium raceme-like	A raceme-like monochasium, flowers erect
Length of Calyx (cm), nerves shape and number	9-12 10-nerved	10-15x2-4 10-reddish nerved	6-8, 10 conspicuously hairy nerves
Calyx	Rather densly pubescent	Subglabrous- or pilose	Conspicuously whitish or pinkish hairy
Size of petal (mm)	12-13x2-3	13-15x5-8	-
Shape of petal	Deply Bifid, Scales conspicuous, 4-lobed	Deply Bifid, two scales	-
Length of Anthophore (mm)	3-3.5	5-7	3
Size and Shape of fruit (Capsule) (mm)	7x4 Narrowly ovoid -oblong	5-7x5-6 broadly ovoid- Subglobose	7.5-5x4.5, Ovoid
Habitat altitude (m)	Sandhills and sand shoes, at sea level	Dry sandy or stony ground, 0-600	Sandy or rocky ground, 0-500
Flowering period	March-May	February-May	February-May

Table 3. Seed morphology of *Silene* species (Figs. 9, 10).

Species/ Seed	Shape	Length-width (mm)	Length-width ratio	Tubercle shape	Surface type	Granulation	Testa cell max. x min. (mm)	Number of suture point per plate	Suture outline	Hylar zone type
S.tenuiflora (K070, West Anatolia)	Reniform	1.9x1.5	1.26	Digitate, Long conical, tip acute	Convex	Medium	0.22-0.24 x 0.04-0.08	15-27	Little Sinuous, Digitate	Little recessed
S. lydia (K067, West Anatolia)	Reniform	1.3x1.1	1.18	Long conical	Concavo-convex	Fine	0.2-0.24 x 0.04	13-18	Little Sinuous	Little recessed
S. discolor (K058, North Cyprus	Reniform	0.8x 0.5	1.4	Low rounded	Flat-Convex	Coarse	0.12-0.13 x 0.02-0.03	10-16	Small Sinuous	Little recessed
S. colorata var.*colorata* (K069, North Cyprus)	Spherical Reniform	1.2x1.1	1.09	Low rounded	Flat	Medium	0.16-0.2 x 0.02	15-25	Small Sinuous	Conspicuous recessed
S. apetala var. *grandiflora* (K055, North Cyprus)	Crinkly reniform	1.5x1.1	1.36	Rounded	Sinuous	Medium	0.18-0.20 x 0.017-0.02	18-26	Serrate	Conspicuous recessed

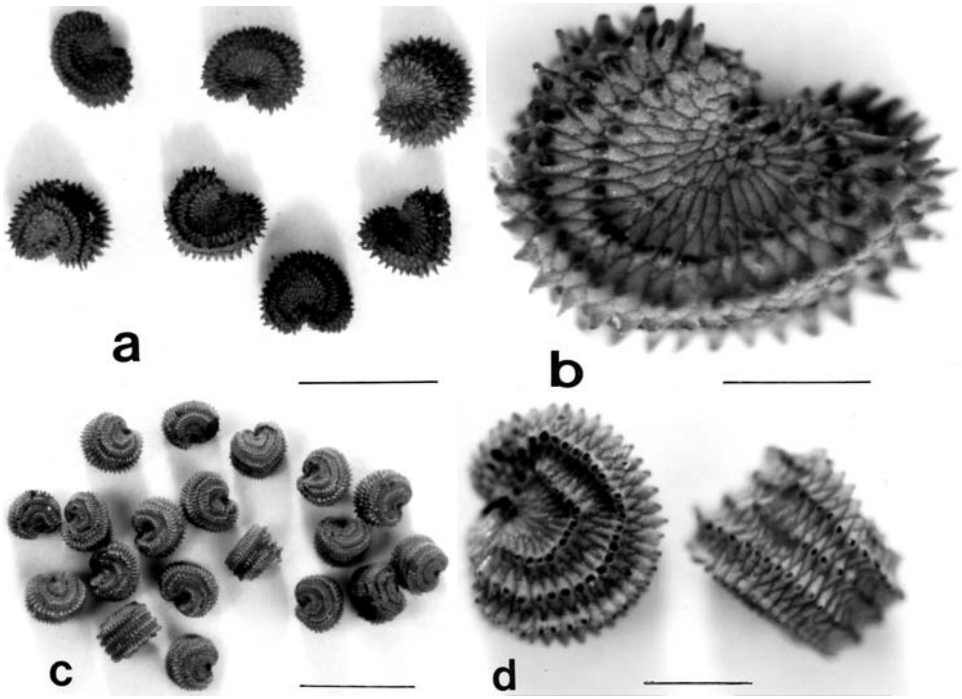

Fig. 9. Light micrographs of *S. tenuiflora* (a, b; K070) and *S.lydia* (c, d; K067) seed.
a, c. General wiew (——: 2 mm), b, d. Seed surface (——: 0.5 mm).

The species with the greatest height is *S. fabaria*,while the shortest is *S. lydia*. The flowers are monochasium and dichasium. The longest calyx is in *S. sipylea* and the shortest in *S.apetala* var. *grandiflora*. The calyx of *S. lydia, S. discolor*, *S. colorata* var. *colorata* and *S. apetala* var. *grandiflora* is puberulent, that of *S. sipylea*, *S. fabaria* and *S. tenuiflora* is glabrous. The calyx of *S. fabaria*, *S. tenuiflora* and *S. apetala* var. *grandiflora* had 10 anastomotic veins, whereas *S. discolor*, *S. colorata* var. *colorata* and *S. sipylea* had 10 veins which are not anastomotic. In *S. lydia*, on the other hand, 25-30 veins were observed. *S. apetala* var. *grandiflora* did not have a petal, whereas the longest petal was found in *S. sipylea*. The petal blade of all species that were examined either deeply or slightly cleft (bifid), the deepest cleft being in *S. fabaria* and *S. discolor*, and the slightest in *S. lydia*. Ligula were observed in the basal petal blades of all species. The ligula are quite small in *S. sipylea* and *S. lydia*. In *S. lydia*, the anthophore is about 1 mm, while it reaches 25-30 mm in *S. sipylea*. The capsules of all species are of an ovoid, spherical shape (Figs. 2-8, Table 2, 3).

The seeds of *S. colorata* var. *colorata* and *S. apetala* var. *grandiflora* are distinct from those of other species in that they are reniform, round, winged and wrinkled (Figs. 10 c, d, e, f; Table 2, 3). The largest seeds were observed in *S. tenuiflora* and the smallest in *S. discolor* (Figs. 9a, b; 10a, b; Table 2, 3). Tubercles were relatively distinct and had a long conical shape in *S. lydia* and *S. tenuiflora*, and the deepest hilum indentation was observed in the seeds of *S. colorata* var.*colorata* and *S. apetala* var. *grandiflora*. The seed surface, which is sinuous in *S. apetala* var. *grandiflora*, and flat, convex in *S. discolor* and *S. colorata* var. *colorata*, can be easily distinguished from that of other species.

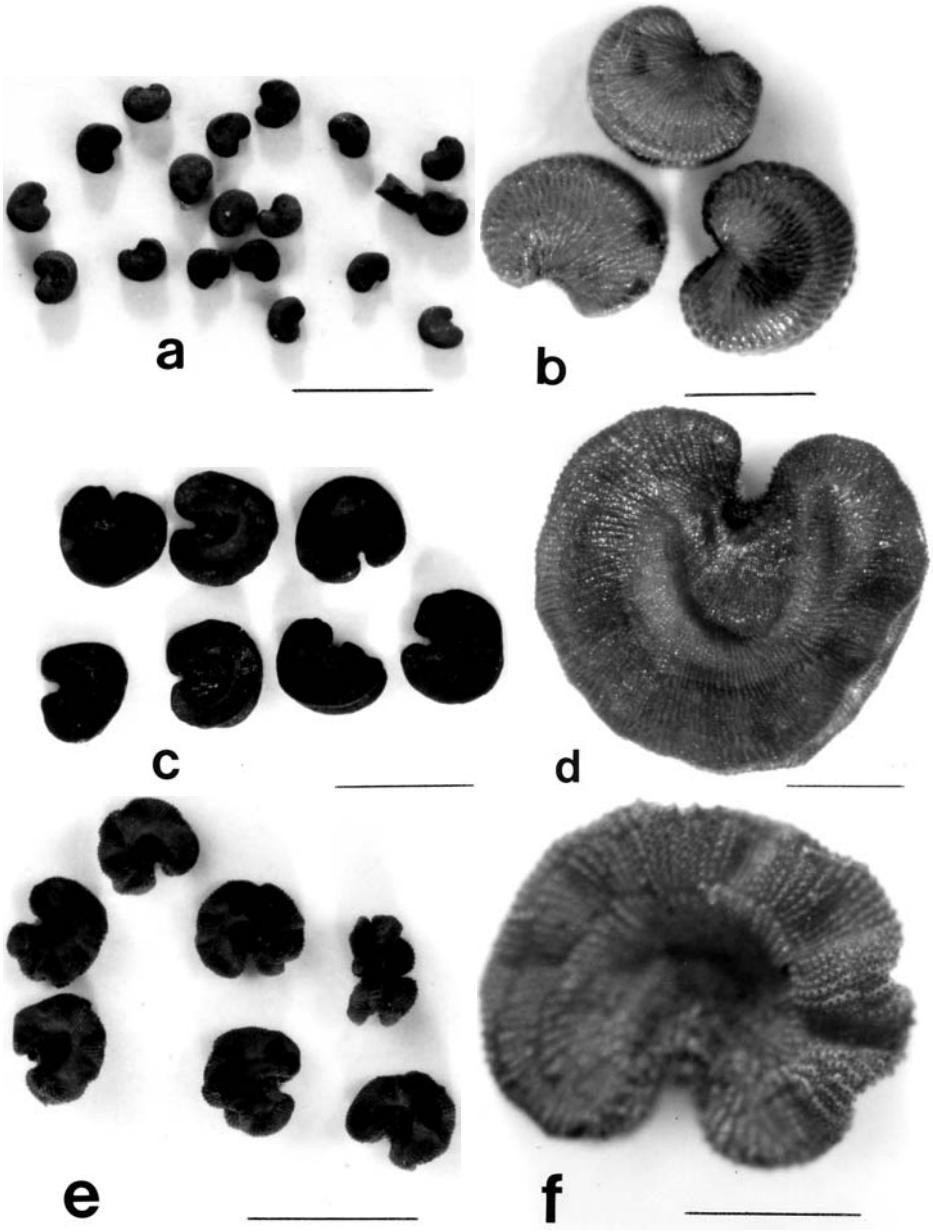

Fig. 10. Light micrographs of *S. discolor* (a, b; K058) , *S. colorata* var. *colorata* (c, d; K069) and *S. apetala* var. *grandiflora* (e, f; K055) seed. a,c, e. General wiew (——: 2 mm), b,d,f. Seed surface (——: 0.5 mm).

Yıldız & Çırpıcı (1998) worked on seed morphology of the *Silene* species distributed in Turkey, using a stereo and scanning electron microscope. In this study which was conducted on *S. chlorofolia* Sm. from the section *Sclerocalycinae*, also includes *S.*

sipylea and on *S. vulgaris* (Moench) Garcke var. *vulgaris*, *S. fabaria*, from the section *Inflatae*, seed structures were termed reniform, ovate; seed tubercles low round and long cylindrical, demonstrating similar features with the species under study. In this study on *Caryophyllaceae* species of North Anatolia, Yıldız (2002) stated the seed types of the *Silene* species [*S. montbretiana* Boiss., *S. caryophylloides* subsp. s*ubulata* (Boiss.) Coode & Cullen, *S. conica* L.] as reniform, tubercles as obtuse, seed surface as flat, concave and convex, testa surface cell walls (suture outline) as sinuous and sharp toothed.

In a choronological study on the *Caryophyllaceae* taxa of North Anatolia, Yıldız & Çırpıcı (2002) determined the morhological characteristics of *S. sangaria* Coode & Cullen, which is endemic to Turkey and grows on the Black Sea coast (Izmit), as creeping, leaves obovate-spathulate, flowers panicle, calyx densely puberulent, 12-15 mm, 2 ligula on the deeply bifid blade base, anthophore, 5-6 mm, capsule 5-8 x 4-6 mm. As for the seed characteristics of *S. sangaria*, the surface is flat, sometimes round, cell plate length and width 0.140-0.170 x 0.040-0.065 mm, number of suture point per plate 10-15 and the cell suture outline sinuous (Yıldız & Çırpıcı, 1998). Despite belonging to a different section, *S. discolor*, on which we carried out our studies, demonsrates similar characteristics to *S. sangaria* with respect to the area where it grows, its leaves, calyx pubescence, petal morphology, seed surface, number of suture point per plate and suture outline.

Melzheimer (1987) conducted a study on the taxonomical position of *Silene thebana* and transferred it to *S. fabaria* as a subspecies and expressed as *S. fabaria* (L.) Sm. subsp. *thebana* (Orph. Ex Boiss.) Melzh. The leaves of *S. fabaria* (L.) Sm. subsp. *thebana* (Orph. Ex Boiss.) Melzh. are rather inclined to ovate-oblong from obovate-spathulate, blade usually half the length of the corolla and testa cells often without tubercles. Plant diameter of the thrive specimens 50-70 cm, while that of Dhomokos specimens is 40 cm, perennial, with 5 petals, petal blade split into two, 2 lobbed, each lobe spathulate or oblong and tip round, two ligula at the basal blade, petal base 2.0-2.9 mm, petal blade 3.8-4.3 mm. It was emphased that seed testa cells varied slightly in the plants in Dhomokos region, but there were significant differences in the plants of the thrive population, and that this population showed greater similarities to subsp. *fabaria* rather than subsp. *thebana*. The subsp. *fabaria*, which we studied, exhibited greater resemblance to *S.fabaria* in that its leaves are oblanceolate-lanceolate obovate, its petal length 16-17 mm and it mostly occurs near the coast. Thus, it can be concluded that the species from West Anatolia, under our study belongs to the taxon *S. fabaria* subsp. *fabaria*, which is also distributed in Greece.

References

Authier, P. 1992. Study of the Flora of the Timfi Mountains (Yanina, North-East Greece) (II). Remarks on *Silene remotiflora* Vis. (*Caryophyllaceae*) in Greece. *Bulletin de la Societe Botanique de France, Lettres Botaniques*, 139(3): 265-274.

Davis, P.H. 1967. *Flora of Turkey and East Aegean Islands*, Vol. 2, Edinburgh University Press, Edinburgh.

Davis, P.H. 1988. *Flora of Turkey and East Aegean Islands* (Supplement), Vol. 10, Edinburgh University Press, Edinburgh.

Desfeux, C. and B. Lejeune. 1996. Systematics of Euromediterranean *Silene* (*Caryophyllaceae*); Evidence From A Phlogenetic Analysis Using ITS Sequences, 319(4): 351-358.

Greuter, W. 1995. *Silene* (*Caryophyllaceae*) in Greece: A Supgeneric and Sectional Classification. *Taxon*, 44(4): 543-581.

Güner, A., N. Özhatay, T. Ekim and K.H.C. Başer. 2001. *Flora of Turkey and the East Aegean Islands*, (Suplement 2), Edinburgh at the University Press, Edinburgh.

Meikle, R.D. 1977. *Flora of Cyprus*, Vol. 1, Published by The Bentham,-Moxon Trust Royal Botanic Gardens, Kew.

Meikle, R.D. 1985. *Flora of Cyprus*, Vol. 2, Published by The Bentham,-Moxon Trust Royal Botanic Gardens, Kew.

Melzheimer, V. 1977. Biosystematiche Revision Einiger *Silene*-Arten (*Caryophyllaceae*) der Balkanbinsel (Griechenland). *Bot. Jahrb. Syst*., 98: 1-92.

Melzheimer, V. 1987. On the taxonomic position of *Silene thebana* (*Caryophyllaceae*), *Pl. Sys. Evo*., 1(155): 251-256.

Prentice, H.C. 1978. Experimental taxonomy of *Silene* section *Elisanthe* (*Caryophyllaceae*): Crossing experiments. *Botanical J. of the Linnean Society*, 77: 203-213.

Prentice, H.C. 1979. Numerical Analysis of Infraspecific Variation in European *Silene alba* and *S.dioica* (*Caryophyllaceae*). *Botanical Journal of the Linnean Society*, 78: 181-212.

Prentice, H.C. 1980.Variation in *Silene dioica* (L.) Clairv.; numerical analysis of populations from Scotland, *Watsonia*, 13: 11-26.

Prentice, H.C. 1988. *Silene* section *Elisanthe* in the Iberian Peninsula, Homenaje a pedrpmontserrat. *Monografias Del Instituto Pipenaico De ecologia*, JAKA Num.4.

Stephenson, R. 1993. The Endemic succulents of Cyprus. *Cactus and Succulent Journal*, 65: 6, 301 -305.

Stearn, W.T. 1996. *Botanical Latin*. David & Charles, fourth edi., London, p. 489-491.

Vural, M. and N. Adıgüzel. 1996. Türkiye Florası ile ilgili notlar II: *Silene cserei* subsp. *aeoniopsis, Silene argea* ve *Silene balansae* (*Caryophyllaceae*). *Ot Sistematik Botanik Dergisi*, Cilt 3, Sayı 2, 92-98.

Viney, D.E. 1994. 1996. *An Illustrated Flora of North Cyprus*, Vol.I-II, Published by Koeltz Scientific Books, Koenigstein, Germany.

Yıldız, K. and A. Çırpıcı. 1992. Tokat çevresinin *Silene* türleri üzerinde morfolojik araştırmalar. *Marmara Üniversitesi Fen Bilimleri Enst. Derg*., 1-25.

Yıldız, K. and A. Çırpıcı. 1998. Seed morphological studies in *Silene* L., from Turkey, *Pak. J. Bot*., 30(2): 173-188.

Yıldız, K. 2002. Seed Morphology of *Caryophyllaceae* Species From Turkey (North Anatolia). *Pak. J. Bot*., 34(2): 161-171.

Yıldız, K. and S. Gücel. 2003. Kuzey Kıbrıs Endemikleri Üzerinde Sitotaksonomik Palinolojik Bir Araştırma, Tübitak, TBAG-913 Nolu Araştırma Projesi, Manisa.

(Received for publication 4 September 2004)