



## A NEW RECORD OF *SILENE* L. SPECIES BELONG TO THE FAMILY CARYOPHYLLACEAE

M.M. ALJAF<sup>1</sup>, M.A.H. AL-HADEETHI<sup>1\*</sup>, and P. SUTTHISAKSOPON<sup>2</sup>

<sup>1</sup>Department of Biology, College of Education for Pure Sciences, University of Baghdad, Baghdad, Iraq

<sup>2</sup>Faculty of Environmental Culture and Ecotourism, Srinakharinwirot University, Bangkok, Thailand

\*Corresponding author's email: [muazaz.a.h@ihcoedu.uobaghdad.edu.iq](mailto:muazaz.a.h@ihcoedu.uobaghdad.edu.iq)

Email addresses of co-authors: [muhannad.m.a@ihcoedu.uobaghdad.edu.iq](mailto:muhannad.m.a@ihcoedu.uobaghdad.edu.iq), [phanom@g.swu.ac.th](mailto:phanom@g.swu.ac.th)

### SUMMARY

In the presented research, four recorded species of the genus *Silene* belonging to the family Caryophyllaceae attained as newly added species to science in the Iraqi flora. The current work involved the study of the morphological features of the vegetative and floral parts of these new species recorded in Iraq. The newly identified species were *S. muscipula*, *S. nocturna*, *S. latifolia*, and *S. sedoides*, belonging to the family Caryophyllaceae. The collected samples of the different landraces came from separate locations in the Northern Iraqi Mountains. The study also recorded information on locations, longitude, latitude, and collection dates. The diagnosis of four species and their naming relied on flora from neighboring countries, such as the Flora Iranica and Flora of South Africa. After confirmation, the description assessment of vital parts of the new plant species included the shape, leaf venation, length, shape, and calyx tube venation, the modification shapes, appendages of coronal scales petals, and pistil structures. The plant part images of the different landraces also enhanced the morphological characteristics of these new species under study.

**Keywords:** Caryophyllaceae, *Silene*, taxonomy, morphology

**Key findings:** The latest investigation studied the morphological characteristics of four newly registered species belonging to the genus *Silene* L., with the record of these new species also added to the Flora of Iraq.

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## INTRODUCTION

Caryophyllaceae, commonly called the pink or carnation family, is a family of flowering plants. It belongs to the order Caryophyllales and has a botanical distinction of its location in the phylogenetic system of the angiosperms (Judd *et al.*, 2002; Sitte *et al.*, 2002). The large order of Caryophyllales placement is with the most recent lineages of the class with Berberdopsidales and Santalales (APG, 2016; Soltis *et al.*, 2018). For the family Caryophyllaceae, the estimated species are 2300, represented by 87 genera, spread out worldwide, and primarily existing in the regions with high and Northern temperates (Mabberley, 1987).

The Carnation family includes mainly herbaceous plants, morphologically characterized by their simple and opposite leaves, with scarious stipules, often bisexual flowers, and actinomorphic symmetry (Jennersten, 1988). They commonly have one or two stamens in each whorl, and the carpels comprise a single compound pistil; the ovary is superior, containing an equal number of styles, along with fruiting capsules, and involving the ornamental plants, such as *Dianthus* and *Gypsophila* (Yildiz, 2002).

The genus *Silene*, with the name derived from several names, has the name originating from the Greek word 'Sialon,' meaning 'Saliva,' which refers to the sticky secretions produced by some plant parts, such as stems, leaves, sepals, and petals in the main species (Evan, 1933). Additionally, internationally, it also has the names Catchfly or Campion, where the petals are slightly bladder-like in shape and enlarged at the base (Gledhill, 2008). The genus *Silene* L. is one of the largest genera of the world's flowering plants, with more than 700 species belonging to the sub-family Silenoideae of the family Caryophyllaceae (Melzheimer, 1988; Rautenberg *et al.*, 2010). The genus is also widespread in Turkey, Russia, Italy, Iraq, Iran, Eastern Mediterranean countries, Japan, Spain, and England (Jafari *et al.*, 2008).

For identifying and isolating the species, essential diagnostic characteristics of this genus are the shape and venation types of

the sepals, the length and pubescence of the stamens, the shape and size of the leaves and coronal scales, and the style of the capsules and seeds (Ghahermaninejad *et al.*, 2014). Outwardly, it also contains a gamosepalous cup, the number of carpels ranges from three to five, and the shape of the calyx tube differed in the species, from campanulate, clube-clavate, and ovate (Lin *et al.*, 2019).

The family Caryophyllaceae has 24 genera and 135 species represented in Iraq, with 37 species belonging to the genus *Silene* (Chazanfer and Edomndson, 2016) and the species *Silene papillose* Boiss described morphologically and anatomically, became added as the new species to the Iraq flora (Musa, 2008). These species also spread as wild plants in Iraq, high mountainous regions, and the Western and Southern deserts (Al-Rawi, 2014). The pertinent study aimed to diagnose and classify those species existing in specific areas of Iraq and register them as new species for the first time in Iraq.

## MATERIALS AND METHODS

Fresh plant specimens collected from the concerned landraces during the field survey included four genus *Silene* species. The collection occurred at the flowering and fruiting stages from different locations in the mountainous areas in Northern Iraq. The first species, *S. muscipula*, was prevalent in the Rania-Doukan Motorway, Sulaimaniyah Province, between the longitude 44° 43.5890'E and latitude 36° 7.4720'N, and Kharajian, Sulaimaniyah Province, between longitude 44.5° 33.2150'E and latitude 35° 27'. The second species, *S. nocturna*, was dominant in the Pera Magroon Mountain, Sulaimaniyah, between longitude 45° 0.8300'E and latitude 35° 52.6840'N. The third species, *S. latifolia* ♀, existed in Balkiyan Mountain-Penguin, Sulaimaniyah Province, between longitude 45° 58.1800'E and latitude 35° 35.6820'N, 1790'N, and also in the Zeni-Warti region, Erbil, between longitude 44° 45.3630'E and latitude 36° 27.3460'N. The fourth species, *S. latifolia* ♂, prevailed in the Balkiyan Mountain-Penguin, Sulaimaniyah Province, between

longitude 45° 58.1800'E and latitude 35° 35.6820'N, 1790'N. The fifth species, *S. sedoides*, persisted in the Perkh-Zakho, between longitude 37.148'E and latitude 42.678'N. For the said locations, the latitude and longitude verifications used Google Maps, in addition to following the plants (Nadir *et al.*, 2020). Finding and identifying all these new species transpired from April to June 2023 (Figure 1).

The plant samples underwent the following steps: dried and compressed by the plant presser and after drying, set on sheets of cardboard, with each sample fixed with a card label containing necessary information, such as scientific name, place of collection, the name of collector, the date of the collection, and information about the environmental factors, such as soil type and altitude, following past studies (Khalaf and AL-Hadeethi, 2020; Al-Hadeethi *et al.*, 2021). Depositing all samples continued in the herbarium at the College of Education for Pure Sciences, Ibn-AL-Hathiam, Baghdad University, Baghdad, Iraq. Moreover, recording some of the plant parts by photography used a Dissecting Stereomicroscope camera type (Taida TD-

HU708A), while shooting other parts (calyx and petal with stamen) also used a digital camera (SAMSUNG SM-S908E/DS).

## RESULTS AND DISCUSSION

In the presented investigations, the morphological features of the four species of the *Silene* genus under study were visible. The latest findings' comparison with the species already added to the Flora of Iraq also included the presented research, adding the measurement of plant parts for the current species under study (Tables 1 and 2). All the studied characteristics were important and diagnostic for differentiating the studied species, such as leaf shapes and apexes and the presence and absence of hairs and their shapes (Ranwashee, 2018; Mifsud, 2022). The results of the phenotypic characteristics showed the possibility of dividing the taxonomic species for the genus *Silene*, with the male (androecium) and female (gynoecium) systems divided into two main groups.



**Figure 1.** Locations of collected samples.

**Table 1.** Morphological features of *Silene* species.

No.	Species	Features
1	<i>S. latifolia</i>	Plant dioecious with unisexual flowers, petals white, styles 5 Plant monoecious with bisexual flowers, petals pink, styles 3 Leaf apex acute, lanceolate, calyx tube cylindrical and green color, coronal scales of petals bifid
2	<i>S. sedoides</i>	Leaf apex obtuse, obovate, fleshy - succulent, calyx tube clavate and brown color, coronal scale of petals retuse
3	<i>S. nocturna</i>	The stem branches non sticky at top, veins of calyx are fused at apex, teeth of calyx similar in length, the flowers are arranged in a monochasial, coronal scales, oblong, about $\frac{3}{4}$ length of the limb
4	<i>S. muscipula</i>	The stem branches very sticky at top, veins of calyx not fuse at apex, teeth of calyx varying in length, the flowers are arranged in a dichasial, coronal scales, oblong, about $\frac{1}{2}$ length of the limb

**Table 2.** Comparison of morphological features of *Silene* species.

Morphological features	<i>S. muscipula</i>	<i>S. nocturna</i>	<i>S. sedoides</i>	<i>S. latifolia</i> ♂ Androecium	<i>S. latifolia</i> ♀ Gynoecium	Flora of Iraq
Leaf shape and dimension	Lanceolate to linear shaped narrowly the length (2.2–2.5 cm) and width (2 mm)	Lanceolate shape to spatulate slightly the length (2.5–3 cm) and width (3– 5 mm)	Obovate to elliptical shaped, fleshy – succulent the length (1.2–1.5 cm) and width (4 mm)	Elliptical to lanceolate broad shaped the length (4–7 cm) and width (6–20 mm)	Elliptical to ovate shape the length (4–9 cm) and width (8–30 mm)	Non record
Leaf apex	Acute	Acute	Obtuse	Acute	Acute	
Calyx tube length	1.7–1.9 cm	1.5–1.8 cm	6–8 Cm	1.8–2 cm	2–2.2 cm	
Calyx shape	Cylindrical	Cylindrical, urn-shaped	Clavate shape approximately	Campanulate- shape approximately	Bladder-like shape	
Calyx veins number	10	10	10	10	20	
Coronal scales	Bifid oblong	Bifid deeply oblong	Retuse	Bifid - undulant outer margins	Bilobed - entire outer margins	
Appendages petal shape	Serrate	Lobed	Finger- like short	Serrate	Finger-like	
Pistil length	0.6–1 cm	5–8 Cm	5–9 Cm	-----	2–2.5 cm	
Ovary shape	Scepterum-like elongated	pyriform-like	pyriform-like slightly	-----	dumbbell-like	
Styles number	3	3	3	-----	5	

### **Monomorphism (bisexual) species**

The group included plant species that bear both the male and female flowers, and the study included the species below:

#### ***Silene muscipula* L. (Alq ed-debban or Lesca catchfly)**

An annual herb, shiny in appearance, the stems are erect, branched, and sticky at the top. The flowers were sharply erect and petiolate, arranged in a dichasial, and these results were analogous to past findings (Ranwashee, 2018).

The roots were 8–12 cm long, thin, and with little branches (Figure 2A). The stem was erect, usually branched, 20–40 cm long, cylindrical, green, and sticky at the apex (Figure 3A). The leaves were sessile, 2.2–2.5 cm long and 2 mm wide, lanceolate-linear shaped narrowly, slightly ciliate in the margin, and acute apex (Figure 3A). The leaf venation type was acrodromous, where the leaf has two or more primary and strongly developed secondary veins running in convergent arches toward the leaf apex. Arches did not recurve at the base; also, the veins were basal, which means the acrodromous veins originated at the base of the leaf, and the development was imperfect in this way. The acrodromous veins ran less than two-thirds of the distance from the leaf's apex (Figure 4A).

The calyx tube was cylindrical, elongated with narrow basal edges, green, 1.7– 1.9 cm long, containing 10 veins tapered at the basal third and gradually thickening at the middle and apical thirds, five of which extend from the base to the end of each tooth, while the remaining extend parallel to the edges of the teeth. The teeth were lanceolate, sharp-edged, elongated with varying lengths, and fully covered with slight pubescence (Fig. 5/A). The petals with stamens were pink, the limb length was 6–8 mm, and its width was 4– 5 mm. The claw length was 1–1.2 cm, and the width was 3–4 mm. The appendages were serrate, coronal scales bifid, oblong, about 1/2 long of the limb, and wavy edges, with two stamens in each ring (Figure 6A). The pistil length was about 0.6–1 cm. The ovary was

scepterum-shaped and elongated, the styles were short, three in number, and the stigmas were cusped (Figure 7A).

#### ***Silene nocturna* L. (Night-flowering catchfly)**

An annual herb belonging to the carpetweed group, the flowers have a monochasial spike-like arrangement, and these results correspond with past findings (Ranwashee, 2018). The root elongates, 5–9 cm long, with little thick branches (Figure 2B). The stem was erect, usually branched, 10–60 cm long, cylindrical, green, and with a wand-like shape (Figure 3B). The leaves were sessile, 2.5–3 cm long and 3– 5 mm wide, lanceolate shape to slightly spatulate, ciliate in margin, and acute apex (Figure 3B). The leaf venation was acrodromous, basal, imperfect, and equal to the *S. muscipula* L. species (Figure 4B).

The calyx tube was cylindrical, elongated, urn-shaped, narrowing at basal margins, green, covered by dense pubescence, and 1.5–1.8 cm long, containing 10 thin veins at the basal and middle thirds that thicken at the apex, five of which extend from the base to the end of each tooth. The remaining extends parallel to the edges of the teeth, fusing in the distal half with the tooth veins. The teeth are narrow, triangular-lanceolate in shape, elongated, and equal in length. Short hairs covered the veins (Figure 5B).

The petals with stamens were pink-white pinkish, the limb length was 6–8 mm, and its width was 4 mm. The claw was auricular, elongated, 7–9 cm long and 2 mm wide. The appendages were lobed, coronal scales bifid deeply, oblong, about 3/4 long of the limb, with two stamens in each ring (Figure 6B). The pistil length was about 5–8 mm. The ovary was pyriform-like shaped, styles were short, and three in number, with the stigmas cusped, and the gynophore was short (Figure 7B).

#### ***Silene sedoides* Poir (Hairy catchfly)**

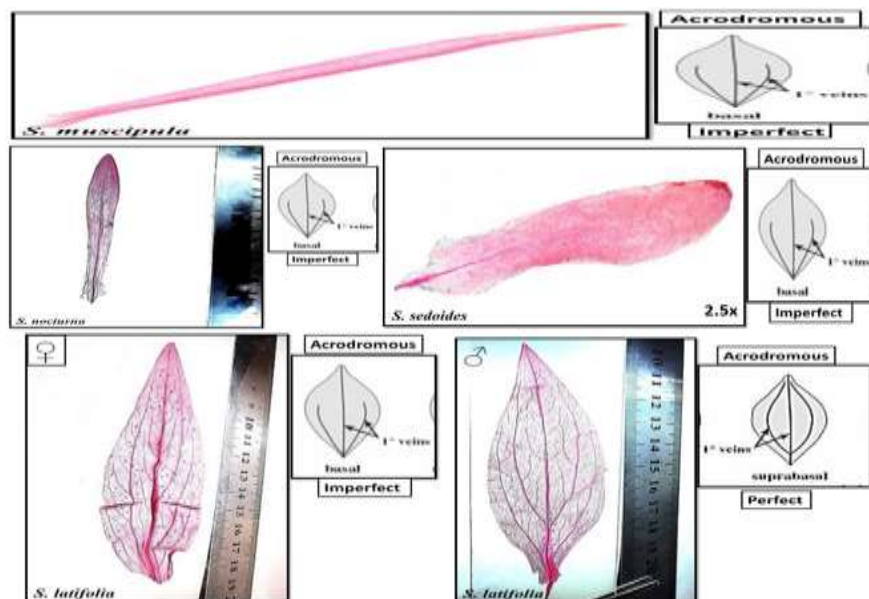
Small, annual herbaceous plants are prevalent, especially in rocky coastal areas. It branched a lot, covered with elongated and fleshy leaves,



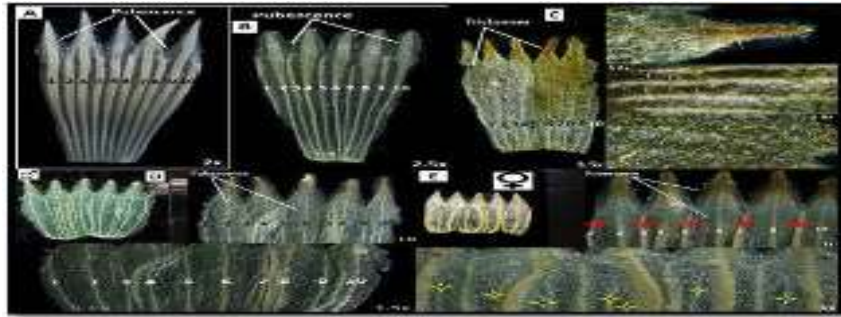
**Figure 2.** Shape of plants in the field: A- *S. muscipula*, B- *S. nocturna*, C- *S. sedoides*, D- *S. latifolia*♂, E- *S. latifolia*♀.



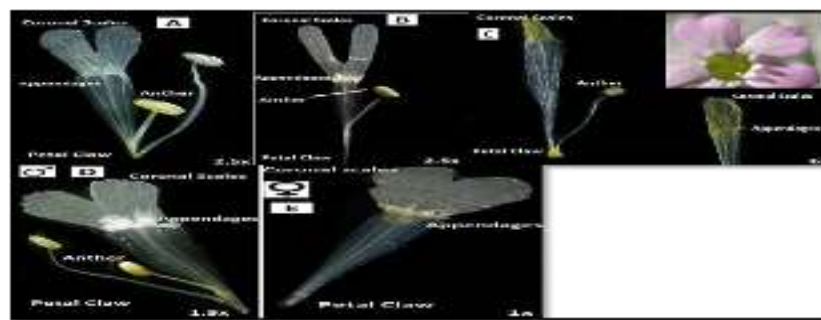
**Figure 3.** Leaf and Stem: A- *S. muscipula*, B- *S. nocturna*, C- *S. sedoides*, D- *S. latifolia*♂, E- *S. latifolia*♀.



**Figure 4.** Leaf venation: A- *S. muscipula*, B- *S. nocturna*, C- *S. sedoides*, D- *S. latifolia*♂, E- *S. latifolia*♀.



**Figure 5.** Calyx tube: A- *S. muscipula*, B- *S. nocturna*, C- *S. sedoides*, D- *S. latifolia*♂, E- *S. latifolia*♀.



**Figure 6.** Petal with stamen: A- *S. muscipula*, B- *S. nocturna*, C- *S. sedoides*, D- *S. latifolia*♂, E- *S. latifolia*♀.



**Figure 7.** Pistil: A- *S. muscipula*, B- *S. nocturna*, C- *S. sedoides*, D- *S. latifolia*♀.

with many flowers. The petals were tiny and distinguished by a sticky touch. It is due to glandular hairs that coat the entire plant (Mifsud, 2022).

The roots were medium length (1.5–2.5 cm), moderately thick, and branched (Figure 2C). The stem was erect, usually branched, 5–20 cm long, cylindrical, dark brown in the freshly collected samples, and

mainly hairy (Figure 3C). The leaves were sessile, 1.2–1.5 cm long and 4 mm wide, dark brown, obovate–elliptical shaped, fleshy-succulent thickly, apex obtuse, and coated by dense hairy glandular (Figure 3C). The leaf venation was acrodromous, basal, and imperfect, as in the *S. muscipula* L. species (Figure 4C).

The calyx tube was elongated, clavate shape approximately, brown, 6–8 mm long, containing 10 thin veins, five extended from the base to the end of each tooth. The remaining extends parallel to the edges of the teeth. The teeth were short, triangular-lanceolate in shape, and equal in length. Elongated multicellular glandular hairs covered the veins and teeth of the calyx (Figure 5C).

The petals with stamens were pink, the limb length was 3–5 mm, its width was 2–3 mm, and the claw length was 5–8 mm and 1 mm wide. The appendages were short finger-like, coronal scales retuse, with two stamens in each ring (Figure 6C). The pistil was 5–9 mm long. The ovary was pyriform-like shaped, the styles were short, three in number, and the stigmas were slightly hairy (Figure 7C).

### **Dimorphism (unisexual) species**

This group is distinct, with a unique species, i.e., *Silene latifolia* Poir., which includes male (staminate) and female (pistillate) flowers.

#### ***Silene latifolia* Poir (White campion)**

A short-lived biennial herbaceous plant, perennials, and sometimes annuals, reaching a height of approximately 80–100 cm in both male and female flowers. Its common name is bladder campion in the USA (Gonçalves and Rüben, 2016). The male root length was about 10–14 cm, less thick, and branched than the female roots (Figure 2D). The female root length ranges between 13–15.5 cm, thicker and dense with branches and sub-branches (Figure 2E). The male + female stems were erect, vastly branched, 80–130 cm long for both males and females, cylindrical, and dark brown, alternating to green in the male while green in the female (Figures 2, 3D, E).

The male leaves were slightly sessile, apex acute, 4–7 cm long, 6–20 mm wide, green, elliptical to lanceolate broad shaped, and coated by less white hairs dispersed on the blade (Figure 3D). The female leaves are also similar approximately to male leaves, however broader than they are in length (4–9 cm) and width (8–30 mm), and elliptical-ovate in shape (Figure 3E).

The male leaf venation was acrodromous, and the leaf has two or more primary and strongly developed secondary veins running in convergent arches toward the leaf apex. Arches did not recurve at the base, and the veins were suprabasal, which means the acrodromous veins originating from some distance above the leaf base and the development were perfect, running at least two-thirds of the distance to the leaf apex (Figures 4D, E). The female leaf venation was also acrodromous, basal, and imperfect, as in the *S. muscipula* L. species.

The calyx tube elongates in the males, slightly swollen, approximately campanulate-shape, and brown in freshly collected samples. The length was 1.8–2 cm, containing 10 thin veins, five extending from the base to the end of each tooth. Meanwhile, the remaining others extend from the base to the edges of the teeth. The teeth were triangular-lanceolate in shape and equal in length, with less pubescence covered by margin veins (Figure 5D).

The calyx tube in females was more inflated and wide, resembling a bladder-like shape, green, ranging 2–2.2 cm long, comprising 20 veins, five chief enlarged veins extending from the base to the end of each tooth, and five secondary medium-sized veins ending at the edges of the tooth. The remaining 10 veins branched off from the secondary veins in pairs on either side. The teeth were triangular and of similar length, covered with slight white hairs (Figure 5E).

The male petals with stamens were white, consisting of medium limbs, 7–9 mm long and 0.9–1 cm wide. The claw elongated with 1.5–1.7 cm length and 3–4 mm width. The appendages were serrate, coronal scales bifid, and undulant outer margins, with two stamens in each ring (Figure 6D). Likewise, the female petal was white, 0.9–1 cm long, and 6–9 mm wide. The claw elongates more than the male claw; its length was 1.8–2 cm, and the width was 3 mm. The appendages were similar to the male, with coronal scales bilobed and entire outer margins (Figure 6E).

The pistil length was about 2–2.5 cm. The swollen ovary resembled a dumbbell-like shape, wasted in the middle, and inflated at



the terminals. The styles were long, five in number, slightly twisted at the top, with their inner edges with horned papillae (Figure 7D). Such type of morphological traits play an important role in diversity of various crops species (Aipeisova *et al.*, 2023; Hussain *et al.*, 2023; Khan *et al.*, 2023).

## CONCLUSIONS

Fresh plant specimens collected during the field survey included four species of the genus *Silene* belonging to the family Caryophyllaceae. The scrutiny in the laboratory of morphological features compared these new characteristics with other plants in the flora of neighboring countries of Iraq. The study also authenticated that recording and studying these four species, *S. muscipula*, *S. nocturna*, *S. latifolia*, and *S. sedoides*, emerged for the first time in Iraq.

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