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Research paper

Epilobium ciliatum Raf. (Onagraceae), a Newly Naturalized Species in Taiwan

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ABSTRACT

Epilobium ciliatum Raf., a species native to the Americas and northeastern Asia (Russian Far East, northeastern China, Japan, and Korea), has recently become naturalized in the montane regions of north-central Taiwan. The seeds of *E. ciliatum* bear flattened papillae that are fused together, forming conspicuous longitudinal rows, a feature that distinguishes it from other Taiwanese species of the genus, which have papillose or reticulate seed surfaces. This study provides a detailed morphological description of *E. ciliatum* accompanied by photographs, light and scanning electron microscope images, a distribution map, and a key for the identification of the naturally occurring species of *Epilobium* L. in Taiwan.

Keywords: *Epilobium* L., newly naturalized, Onagraceae, Taiwan

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INTRODUCTION

Epilobium L., the largest genus in the Onagraceae, has a worldwide distribution. It comprises approximately 180–200 taxa (Chen et al., 1992; Lorimer, 2007; Solomon, 1982; Wagner et al., 2007) and is a common component of temperate floras. Many species have broad geographical ranges (Chen et al., 1992). Prior to this study, seven taxa of *Epilobium*, comprising six species and one subspecies, had been reported from Taiwan (Lievens and Hoch, 1993).

Epilobium ciliatum Raf. is native to northeastern Asia, including the Russian Far East, northeastern China, Japan, and Korea (Chen et al., 1992), as well as North and South America, with a distribution range extending from Alaska and northern Canada to southern Mexico (Hoch, 2022; Krajšek and Jogan, 2004). Within *E. ciliatum*, three subspecies can be distinguished on the basis of morphology: *E. ciliatum* subsp. *ciliatum*, *E. ciliatum* subsp. *glandulosum* (Lehm.) Hoch & P.H. Raven, and *E. ciliatum* subsp. *watsonii* (Barbey) Hoch & P.H. Raven (Hoch, 2022).

In 2023, we examined an unknown specimen of *Epilobium* (*S.-Y. Lan 1972*; TAI, TNM) collected in Yilan County, Taiwan, in 2021, and found that it differed from all native species of *Epilobium* previously recorded in Taiwan. The specimen has dense glandular hairs in the inflorescence and on ovaries, as well as lanceolate leaves, and resembles *E. brevifolium* subsp. *trichoneurum*, but differs in its denticulate leaf margins.

After field collections and comparison with herbarium specimens, we found that the seeds are characterized by conspicuous longitudinal rows of flattened, fused papillae, a feature that contrasts with the reticulate or papillose seed surface of other Taiwanese species. Based on this feature, we identified this previously unrecorded taxon as the newly naturalized *E. ciliatum* subsp. *ciliatum*.

In this study, we present a detailed description of *E. ciliatum*, including photographs, a distribution map for Taiwan, and an identification key to distinguish it from other species of *Epilobium* in Taiwan.

MATERIAL AND METHODS

Specimen collection and herbaria examined

Field collections were made in Taiwan, and voucher specimens were deposited in the National Museum of Natural Science (TNM). The following herbaria were examined: CHIA, HAST, PPI, TAI, TAIE, TAIF, TCF, TNM and TNU.

Morphological observations and distribution map

After preparing voucher specimens, winter buds from living plants were cultivated in a growth chamber to observe morphological characteristics and to obtain fresh material. External morphology was documented using a digital camera. Seed surfaces were examined using TORI FOCUS and scanning electron microscopy (SEM; Hitachi SU1510). Pollen morphology was investigated using light microscopy (LM; ZEISS Axioplan equipped with a ZEISS Axiocam 105 color camera), TORI FOCUS and SEM. Quantitative morphological characters were measured using ImageJ v.1.54p (Rasband, 2025; Schneider et al., 2012). The distribution map was generated in QGIS v. 3.44.6 with the package developed by Lin (2018).

RESULTS

Diagnostic morphological characters of *Epilobium ciliatum*

The seed surface, characterized by conspicuous longitudinal rows of flattened and fused papillae, may serve as a diagnostic character for distinguishing *E. ciliatum* from other species of the genus (Chen et al. 1992; Coskuncelebi et al. 2017; Lee et al. 2013; Saxén, 2011; Seavey et al. 1977).

Epilobium ciliatum is currently recognized as comprising three subspecies: *E. ciliatum* subsp. *ciliatum*, *E. ciliatum* subsp. *glandulosum*, and *E. ciliatum* subsp. *watsonii*. The subspecies are mainly distinguished by leaf shape, inflorescence development of bracts, petal size and color, fruit indumentum, and the presence or absence of fleshy turions (Hoch 2022; Hoch and Raven 1977). Among them, *E. ciliatum* subsp. *ciliatum* is distributed on all continents except Antarctica, whereas *E. ciliatum* subsp. *glandulosum* occurs in northern North America, northern Europe, the Russian Far East, and Japan; *E. ciliatum* subsp. *watsonii* is restricted to the Pacific coast of North America (Hoch 2022; Krajšek and Jogan 2004).

The Taiwanese material corresponds to *Epilobium ciliatum* subsp. *ciliatum*. It can be distinguished from *E. ciliatum* subsp. *glandulosum* by its fruits bearing as many as or more strigillose hairs than glandular hairs, as well as by its markedly reduced bracts, which are conspicuously smaller than the middle stem leaves in an open, usually branched inflorescence (Bomble 2017).

Morphological characters distinguishing *E. ciliatum* in Taiwan.

In Taiwan, *Epilobium ciliatum* is morphologically similar to *E. amurense* and *E. brevifolium* subsp. *trichoneurum* in leaf shape, leaf size, flower size, fruit size and elevational distribution. However, *E. ciliatum* can be readily distinguished by its denticulate leaf margins and seed surface bearing conspicuous longitudinal rows of flattened, fused papillae. In contrast, the latter two taxa have serrulate leaf margins and seeds with a simply papillose surface (Figures 1 and 2).

Hair morphology also provides useful diagnostic characteristics. *E. amurense* is characterized by distinct raised lines of strigillose hairs decurrent from the petiole margins and extending along the internodes, whereas *E. brevifolium* subsp. *trichoneurum* is characterized by strigillose hairs with a dense admixture of glandular hairs on the inflorescence and ovaries; *E. ciliatum* exhibits a combination of these features and is therefore unlikely to be confused with either species (Figure 2).

Winter-bud morphology provides additional reliable diagnostic characteristics for distinguishing these three taxa. Keating et al. (1982) recognized four major types of winter buds: soboles, underground scaly shoots with elongated internodes; stolons, above-ground leafy shoots with elongated internodes; turions, underground scaly shoots lacking elongated internodes; and rosettes, above-ground leafy shoots lacking elongated internodes. *E. amurense* produces small leafy rosettes, soboles, and stolons, whereas *E. brevifolium* subsp. *trichoneurum* produces soboles and turions. In contrast, *E. ciliatum* produces leafy rosettes (Figure 3), and its axillary buds occasionally develop into rooted rosette buds.

Although the corolla color of *E. ciliatum* observed in Taiwan ranges from pale violet or pale pink to mauve to dark rose–purple, resembling that of some individuals of *E. brevifolium* subsp. *trichoneurum* and differing

Figure 1. Morphological characters of *Epilobium ciliatum* Raf. in Taiwan
(A) Leaf morphology, 1–11 adaxial surface; 1′–11′ abaxial surface; 4–7 rosette leaves; 1–3 and 8–11 cauline leaves. (B) Flower morphology, a Inflorescence; b Flower longitudinal section; c1 Flower front view; c2 Flower back view; c3 Flower, lateral view; d1 Calyx lobe adaxial surface; d2 Calyx lobe abaxial surface; e1, e3 Petal adaxial surface; e2, e4 Petal abaxial surface; f Style and stigma; g1–4 Outer stamens; g5–8 Inner stamens; h Seed; i Capsule, Abbrevations; br Bract; ca Calyx lobe; cl Corolla lobe; ct Corolla tube; fr Fruit; is Inner stamen; os Outer stamen; ov Ovary; pe Pedicel.

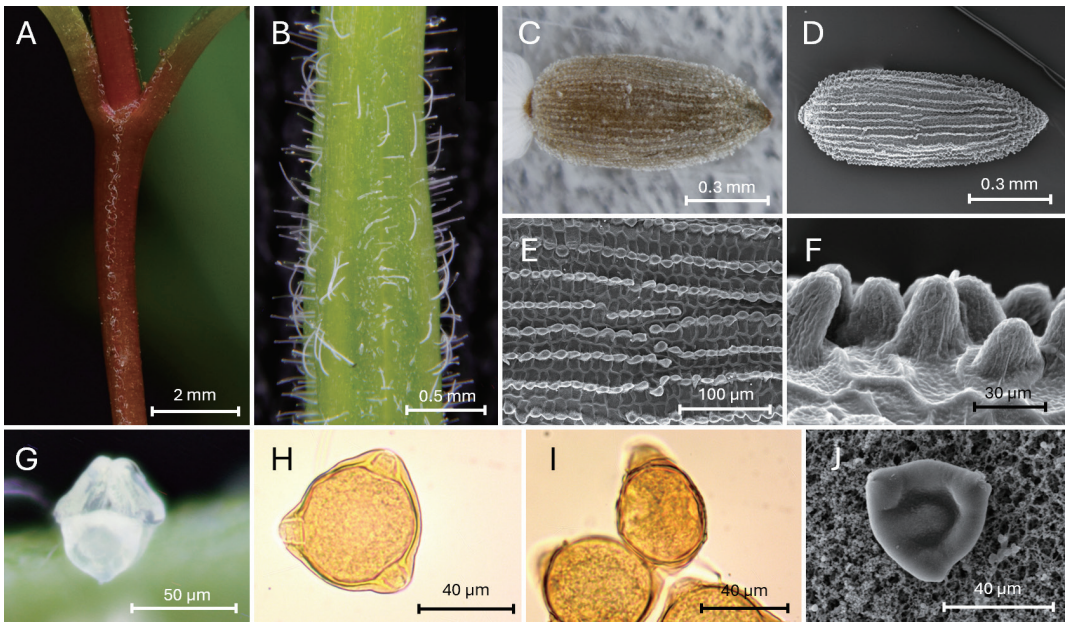

Figure 2. Micromorphological characters of *Epilobium ciliatum* Raf. in Taiwan
(A) Two or four raised strigillose lines decurrent from margins of petioles extending along the internodes. (B) Ovary hairs. (C) Seed. (D) Seed under SEM. (E) Seed surface with longitudinal rows of fused papillae, SEM. (F) Flattened and fused papillae, SEM. (G) Pollen grains released as tetrahedral tetrads. (H) Polar view, LM. (I) Equatorial view, LM. (J) Polar view, SEM.

from the consistently white or rose-purple corolla of *E. amurense*, Solomon (1982) noted that corolla color in *E. ciliatum* is environmentally influenced and may vary from white or pink, sometimes fading to faint pink or darker pink at anthesis. Therefore, corolla color should not be regarded as a reliable diagnostic character for species identification. Morphological comparisons among the three morphologically similar species are summarized in Table 1.

Distribution of *E. ciliatum* globally and in Taiwan

Epilobium ciliatum subsp. *ciliatum* is one of the most widely distributed taxa within the genus. It has been suggested to have originated in western North America based on chromosomal affinities and morphological similarities, and is native to North and Central America, where it ranges from Alaska and northern Canada to southern Mexico and Guatemala (Hoch 2022). It is also considered native to South America, where it occurs along the Andes of Chile and Argentina (Solomon 1982), and northeastern Asia, including the Russian Far East, northeastern China, Japan, and Korea (Chen et al. 1992, 2007; Hoch 2022). In contrast, it is regarded as adventive in Europe, western Russia, the Pacific Islands, Australia, and New Zealand (Aymerich 2023; Branquart et al. 2010; Downey and Taylor 2022; Fernández-Alonso 2012; Hovda 1973; Imada et al. 2025; Iwatsuki et al. 1999; Krajšek and Jogan 2004; Lorimer 2007; Mansanet-Salvador et al. 2014; Preston 1988; Shovkun and Zernov 2023; Smejkal 1997; Tretyakova 2011; Tzvelev 2007; Verloove and Silva 2022).

Figure 3. Habitat and field morphology of *Epilobium ciliatum* Raf. in Taiwan
(A–E) Habitats and plants in the field. (F) Inflorescence. (G) Winter buds. (H) Flowers. (I) Immature capsules. (J) Mature capsules. (K) Seeds. Photographs B, E, and H–K were taken by C.-S. Cheng.

Table 1. Comparative overview of *E. ciliatum* and related species

	E. ciliatum	***E. amurense***	***E. brevifolium* subsp. *trichoneurum***
Winter buds	rosettes	rosettes, soboles, stolons	soboles, turions
Leaf	24.4–84.6 × 6.7–25.2 mm	8.2–46.4 × 3.5–25.4 mm	7.7–67.3 ×2.1–15.1 mm
Leaf L/W ratio	2.3–4.3	1.8–4	2.2–4.7
Leaf shape	lanceolate to narrowly ovate, rarely oblong	ovate, sometimes elliptic, oblong or lanceolate	lanceolate to narrowly ovate, rarely oblong
Leaf margin	denticulate	serrulate	serrulate to weakly serrulate
Petal length	4.1–6.5 mm	2.9–7 mm	2.5–5 mm
Corolla color	pale violet or pale pink to mauve to dark rose–purple	white or rose–purple	pink to rose–purple
Capsule length	21.4–62.9 mm	28.9–79.6 mm	30.5–73.2 mm
Seed size	0.78–0.95 mm	0.73–1.11 mm	0.71–1.03 mm
Seed surface	longitudinal rows of flattened, fused papillae	papillose	papillose
Stem hairs (hair lines)	2 or 4 strigillose hair lines, extending throughout the internodes	2 or 4 strigillose hair lines, extending throughout the internodes	no hair lines or sometimes with broad 2 or 4 strigillose lines, not extending throughout the internodes
Stem hairs (except for hair lines)	strigillose all over, with a densely admixture of glandular hairs at upper part near inflorescence, glabrescent at the lower part	glabrous to subglabrous	strigillose all over, with a densely admixture of glandular hairs at upper part near inflorescence, sometimes glabrescent at woody base
Inflorescence hairs (hair lines)	2 or 4 inconspicuous strigillose hair lines	2 or 4 strigillose hair lines, with admixture of glandular hairs	no hair lines
Inflorescence hairs (except for hair lines)	strigillose all over, with densely admixture of glandular hairs	glabrous to subglabrous	strigillose all over, with densely admixture of glandular hairs
Distribution	Naturalized, 1,900–2,300 m	Native, (700–)1,000–3,400 m	Native, (700–)1,800–3,600 m
Conservation status in Taiwan	not assessed in Taiwan	LC (Editorial Committee of the Red List of Taiwan Plants, 2017)	LC (Editorial Committee of the Red List of Taiwan Plants, 2017)

In Taiwan, *E. ciliatum* has been recorded in north-central Taiwan, ranging from the Lishan region to Siyuan Wind Gap near Nanshan Village along Provincial Highways 8 and 7A, at elevations of approximately 1,900–2,300 m (Figure 4). Examination of specimens from several Taiwanese herbaria revealed that the earliest known collection was collected in Nanshan Village, Yilan County, in 2021 (*S.-Y. Lan 1972*; TAI, TNM). Seven additional specimens were collected by our team in the Siyuan Wind Gap and Lishan regions between 2024 and 2026 (*C.-S. Cheng 1*, TAI; *C.-S. Cheng 3*, HAST, PPI, TAI, TAIF, TNM; *R.-H. Suan et al. 418*, *541*, *808*, *813*, *814*, TNM). The species occurs in open to partially shaded, moist, and disturbed habitats, including grassy slopes, roadside drainage ditches, rock crevices, and moss-covered concrete walls (Figure 3).

DISCUSSION

Evaluation of *Epilobium ciliatum* as a newly naturalized species

During cultivation in a growth chamber, we observed that under moist and poorly

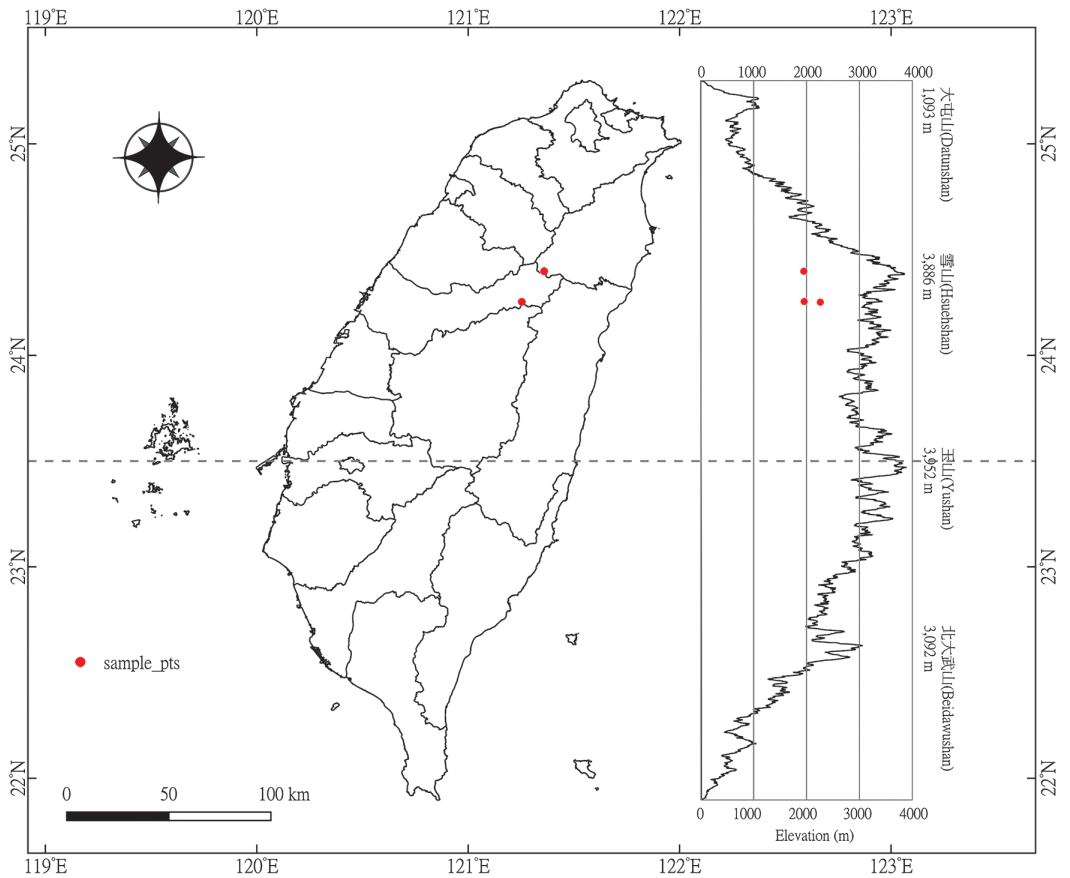

Figure 4. Distribution of *Epilobium ciliatum* Raf. in Taiwan
Red dots indicate documented localities; the right panel shows an elevational profile of Taiwan and the elevations of recorded localities.

aerated soil conditions, axillary buds developed into rooted rosette buds, which subsequently became independent individuals, an observation indicating a capacity for vegetative reproduction that may facilitate establishment and persistence of local populations.

Myerscough and Whitehead (1966, 1967), who studied this species under the name *Epilobium adenocaulon* Hausskn. (now regarded as a synonym of *E. ciliatum*), reported that seedlings established in autumn form rosettes, whereas those established in early summer develop an elongate shoot system from the onset of growth. They also found that plants can flower within 5.5 weeks after germination, whereas *E. montanum*, another widespread European species, requires approximately 7 weeks. The flowers of *E. ciliatum* are capable of self-pollination, and the capsules dehisce approximately 4 weeks after pollination. This short interval from germination to seed release of *E. ciliatum* may facilitate rapid population growth. Notably, although the known localities of *E. ciliatum* in Taiwan are situated at relatively high elevations, these areas are characterized by frequent human disturbance, primarily agriculture and tourism.

According to Wu (2024), more than 60 alien naturalized species have been recorded in this region, with the families Asteraceae and Poaceae being the most represented and approximately half originating from Europe or Eurasia. This pattern suggests that introductions may be associated with the importation of agricultural materials, such as fertilizers or crop products. *E. ciliatum* may have been introduced through similar pathways and subsequently become naturalized. Consistent with this pattern, *E. ciliatum* has been reported as an alien species in several regions worldwide (Branquart et al. 2010; Fernández-Alonso 2012; Krajšek and Jogan 2004) and is often regarded as a weed (Verloove and Silva 2022). Its invasive success has been attributed to high seed production, wind dispersal, high ecological plasticity, and vegetative reproduction (Krajšek and Jogan 2004).

Between 2024 and 2026, flowering and fruiting individuals were documented in the Lishan region and at Siyuan Wind Gap. Populations in both regions included rosette seedlings, vegetative plants, flowering individuals with immature capsules, and fruiting individuals releasing wind-dispersed seeds. Several extensive populations were also found near Fushoushan Farm in 2026 (Figure 3). As *E. ciliatum* is a perennial species, records from several nearby localities in the Siyuan Wind Gap area in 2021, 2024, and 2025 indicate its persistent occurrence in the region over several years. Together with the presence of multiple life stages and its capacity for vegetative reproduction, these observations support its recognition as a newly naturalized species in Taiwan. Further monitoring is needed to assess its potential to become an invasive species.

Potential impacts of *Epilobium ciliatum* on native *Epilobium* species in Taiwan

Epilobium L. is currently divided into eight sections. Among them, sect. *Epilobium* is the largest section in both the genus and family, comprising approximately 168 taxa distributed worldwide. All *Epilobium* species occurring in Taiwan, including *E. ciliatum*, belong to this section. Most species within section *Epilobium* are capable of interspecific hybridization (Raven 1976; Wagner et al. 2007), likely due to their relatively recent divergence (ca. 20.9 Ma) and subsequent rapid radiation (Baum et al. 1994; Lorimer 2007; Wang et al. 2025).

Saward et al. (2025) found that genetic divergence between parental species pairs producing hybrids of different fertility classes does not differ significantly, suggesting that hybrid seed fertility may be influenced by other mechanisms. Due to the broad distribution of *E. ciliatum*, hybridization between it and other members of *Epilobium* has been reported worldwide, with at least 19 hybrid combinations documented to date (Doogue et al. 1985; Krahulec 1999; Krajšek and Jogan 2004; Kuchyňková 2025; Lewis and Moore 1962; Solomon 1982). A recent study in Czechia further indicated that *E. ciliatum* mainly occurs in disturbed habitats, and that the development and fragmentation of alpine habitats may increase hybridization pressure on rare alpine species (Kuchyňková 2025).

In Taiwan, artificial hybridization between the native *E. amurense* and *E. nankotaizanense* has been successfully achieved (*C.-I. Peng s.n.* & *9134*, HAST). In addition, several specimens collected from areas of overlapping distribution appear to represent putative hybrids, exhibiting intermediate morphological characteristics between *E. amurense*, *E. brevifolium* subsp. *trichoneurum*, *E. hohuanense* and *E. platystigmatosum* (*C.-K. Yang 0659*, TNM; *C.-S. Kuoh 15164*, TNM; *S.-T. Chiu & K.-C. Yang 4660*, TNM; *T.-Y.A. Yang 3624a*, TNM; *T.-Y.A. Yang 19430*, TNM).

Although the current distribution of *E. ciliatum* in Taiwan remains limited, the species has been found to co-occur with *E. amurense* near Fushoushan Farm and at Siyuan Wind Gap (*C.-S. Cheng 2*, TAI; *R.-H. Suan 427*, *430*, *431*, *438*, *544*, *546*, *548*, TNM), suggesting that hybridization between the two species may occur there. Further range expansion may bring *E. ciliatum* into contact with other native species, including *E. brevifolium* subsp. *trichoneurum*, *E. platystigmatosum*, and *E. hohuanense*, all of which commonly occur in disturbed roadside habitats such as those in the Hehuanshan area. *E. ciliatum* may also compete with native *Epilobium* species. In Czechia, *E. ciliatum* has been observed to increase in disturbed habitats where *E. roseum* has declined (Smejkal 1997). The potential risks of hybridization and interspecific competition highlight the need for further investigation and continued monitoring of *E. ciliatum* and its impacts on native *Epilobium* taxa in Taiwan.

TAXONOMIC TREATMENT

Key to species of *Epilobium* in Taiwan

1. Plants sparsely glandular-pubescent throughout; leafy bracts opposite or subopposite; stigma deeply 4-lobed; petals 16–24 mm long; seeds 1.7–2 mm long; pollen polar axis 80–97 μm .... *E. nankotaizanense*
   - Plants glandular-pubescent only on the inflorescence and on the upper stem near the inflorescence, or eglandular; leafy bracts alternate; stigma entire; petals 2.5–7 mm long; seeds 0.7–1.6 mm long; pollen polar axis 41.6–83.2 μm 2
2. Stems glabrous to subglabrous below inflorescence except for 2 or 4 raised strigillose lines decurrent from the margins of the petioles extending throughout the internodes 3
   - Stems pubescent all over below the inflorescence, either lacking raised strigillose lines decurrent from the margins of the petioles extending throughout the internodes, or with inconspicuous, sparsely pubescent lines only near the stem base 4

3. Leaf margins serrulate; inflorescence with sparsely glandular hairs; ovaries with sparsely glandular and strigillose hairs; floral tube with conspicuous tufts of hairs at the insertion of calyx lobes; seed surface papillose ..... *E. amurense*
   - Leaf margins denticulate; inflorescence with densely glandular hairs; ovaries with densely glandular and strigillose hairs; floral tube without conspicuous tufts of hairs at the insertion of calyx lobes; seed surface with conspicuous longitudinal rows of flattened, fused papillae..... .....*E. ciliatum*
4. Leaf margins serrulate; inflorescence rachis and ovaries densely covered with glandular hairs.... *E. brevifolium* subsp. *trichoneurum*
   - Leaf margins denticulate to subentire; inflorescence rachis and ovaries with sparsely glandular hairs or eglandular... 5
5. Plants forming basal turions; stem base often covered with dense persistent imbricate scales.....*E. taiwanianum*
   - Plants forming soboles; stem base occasionally covered with loose basal scales 6
6. Leaves 4.2–21.4 mm wide; leaf L/W ratio 0.5–2.5; ovaries 18.8–23.7 mm long; seed surface reticulates to shallowly papillose ... .*E. pengii*
   - Leaves 0.4–8 mm wide; leaf L/W ratio 2.3–11(–15); ovaries 4.2–16.8 mm long; seed surface papillose or papillose to shallowly papillose 7
7. Plants erect or ascending, loosely or not clumped; stems mostly well-branched throughout; leaves narrowly elliptic to sublinear, 1–42 mm long; floral tube 0.8–1.2 mm wide; seeds 0.7–0.9 mm long, seed surface papillose.....*E. platystigmatosum*
   - Plants ascending or decumbent, forming distinct clumps or mats; stems simple or branched only from caudex; leaves ovate to narrowly elliptic, 2.6–18 mm long; floral tube 1–2.1 mm wide; seeds 1–1.3 mm long; seed surface papillose to shallowly papillose ..... *E. hohuanense*

Epilobium ciliatum Raf., Med. Repos. II 5:361. 1808. subsp. *ciliatum*.

TYPE: U.S.A. Northern Pennsylvania, C. S. Rafinesque (Not located).

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Epilobium adenocaulon Haussknecht, Oesterr. Bot. Zeitschr. 29(4): 119. 1879. TYPE: U.S.A. Ohio, *Drège s.n.* (lectotype: LE; isolectotype: JE (mixed with *Epilobium coloratum*), W).

Epilobium maximowiczii Haussknecht, Oesterr. Bot. Zeitschr. 29: 57. 1879. TYPE: JAPAN. Hokkaido, 1861, *Maximowicz s.n.* (holotype: LE; isotype: W).

Epilobium punctatum H. Léveillé, Bull. Acad. Geogr. Bot. 11: 316. 1902. TYPE: JAPAN. Hokkaido, Aomori, Aug 1901, *Kinashi 7*(“919”) (lectotype: KYO).

Epilobium glandulosum var. *asiaticum* H. Hara, J. Jap. Bot. 18: 241. 1942. TYPE: U.S.S.R. Sakhalin, Toyohara, 6 Aug 1923 (5 Aug on label), *Sawada s.n.* (holotype: TI!).

Perennial herbs, forming compact leafy rosettes at or below ground level near the stem base, axillary buds sometimes developing into rooted rosette buds; petioles of rosette leaves 3–7.7(–9.8) mm long; blade obovate to oblong to ovate, 15.2–49.7 mm long, 3.8–12.7 mm wide, margins subentire to denticulate. Stems erect, sometimes ascending, stem base sometimes woody; reddish brown or green, 32.3–90 cm tall, 0.8–5.3 mm in diameter, unbranched or with up to 13 branches, strigillose all over, with a dense admixture of glandular hairs distally near inflorescence, glabrescent, 2 or 4 raised strigillose lines decurrent from margins of petioles extending throughout

the internodes. Leaves opposite, sometimes subopposite near inflorescence, herbaceous, petiole 0–3.3(–5.8) mm long; blade of cauline leaves 24.4–84.6 mm long, 6.7–25.2 mm wide, L/W ratio 2.3–4.3, lanceolate to narrowly ovate, rarely oblong, base obtuse to rounded, sometimes subcordate, margins denticulate with 5–26 teeth on each side, apex acute to subacuminate, lateral veins conspicuous, 4–7 on each side of the midrib, leaf surfaces glabrous, veins and margins subglabrous to strigillose. Inflorescence erect, strigillose throughout, with a dense admixture of glandular hairs and 2 or 4 inconspicuous raised strigillose lines decurrent from margins of the petiole of leafy bracts through the internode; petiole of leafy bracts 0–2.2 mm long, blade 8–16.2(–21.8) mm long, (1.6–)2.5–6 mm wide, lanceolate; pedicels 1.6–5.2(–8.3) mm long. Flowers erect, buds 1.6–3.1 mm long, 1.1–1.9 mm in diameter, ovoid, with glandular hairs; ovaries green, (12.9–)15.1–19.9 mm long, 0.7–1.1 mm in diameter, densely strigillose with a dense admixture of glandular hairs; floral tube 0.7–1.3 mm long, 1.4–1.8 mm in diameter, with an internal ring of strigillose hairs; calyx lobes green, (1.6–)2.4–3.5 mm long, (0.4–)0.7–1.2 mm wide, lanceolate, densely strigillose with a dense admixture of glandular hairs; petals pale violet or pale pink to mauve to dark rose–purple, 4.1–6.5 mm long, 1.7–2.4 mm wide, L/W ratio 2.1–2.7, obovate, apical notch 1–2.2 mm deep, about 1/4 to 1/2 petal length; filaments purple, often white or yellow-brown at base; longer stamens 1.3–3.4 mm long; shorter stamens 0.48–2.45 mm long; anthers cream or yellowish brown, (0.3–)0.4–1 mm long, 0.2–0.6 mm in diameter, ovoid to oblong; style erect, white, base often cream or yellowish brown, 1.4–2.6 mm long, glabrous; stigma (0.9–)1.2–2 mm long, 0.4–0.9 mm in diameter, clavate to cylindrical. At anthesis, pollen is shed onto the stigma by the longer stamens, the shorter stamens, or both. Capsules erect, 21.4–62.9 mm long, 0.8–1.1 mm in diameter, L/D ratio 36.2–58.5, sparsely strigillose with admixture of glandular hairs; pedicels 5.8–7.7 mm long. Seeds brown, 0.78–0.95 mm long, 0.2–0.4 mm wide, L/W ratio 2.3–4, ovate to lanceolate, with conspicuous chalazal collar 0.01–0.05 mm long; surface with conspicuous longitudinal rows of flattened, fused papillae; coma 4.5–8.3 mm long, dull white, readily detaching. Pollen grains released as tetrahedral tetrads; monads subprolate to prolate, amb convex-triangular, 3-zonoporate, polar axis 56.8–83.2 μm, equatorial axis 42.8–70.5 μm, P/E ratio 1.18–1.41, perimeter (polar view) 180.6–245.2 μm, with viscin threads.

Phenology: Flowering from May to September (rarely November); fruiting from July to January.

Specimens examined: TAIWAN. Yilan County (宜蘭縣): Nanshan Village (南山村), elev. 1927 m, 18 Sep. 2021, *S.-Y. Lan 1972* (TAI, TNM); Siyuan Pavilion (思源亭), elev. 1948 m, 10 Jan. 2024, *R.-H. Suan et al. 541* (TNM); Taichung City (臺中市), Heping District (和平區), Siyuan trailhead of Nanhudashan (南湖大山思源登山口), elev. 1925 m, 10 Jul. 2025, *R.-H. Suan et al. 808* (TNM), *813* (TNM); Lishan Public Health Center (梨山衛生所), elev. 1979 m, 23 Aug. 2024, *R.-H. Suan et al. 418* (TNM); Lishan (梨山), elev. 1936 m, 10 Jul. 2025, *R.-H. Suan et al. 814* (TNM); near Fushoushan Farm (福壽山農場附近), elev. 2257 m, 4 Jul. 2026, *C.-S. Cheng 1* (TAI); 5 Jul. 2026, *C.-S. Cheng 3* (HAST, PPI, TAI, TAIF, TNM).

CONCLUSIONS

Epilobium ciliatum Raf. is reported as a newly naturalized species in Taiwan.

It can be readily distinguished from other Taiwanese species by its seeds which possess conspicuous longitudinal rows of flattened, fused papillae. The species is currently known from north-central Taiwan, including Lishan region and Siyuan Wind Gap, where it occurs in moist, disturbed roadside habitats. Given its potential for further spread and possible hybridization with native species of *Epilobium*, continued monitoring is warranted. This study highlights the importance of documenting newly naturalized taxa and provides a baseline for future taxonomic and ecological studies of *Epilobium* in Taiwan.

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研究報告

臺灣產柳葉菜科新歸化植物 ──東北柳葉菜*Epilobium ciliatum* Raf. (Onagraceae)

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摘　要

背景

柳葉菜屬(*Epilobium* L.)為柳葉菜科(Onagraceae Juss.)中物種數最多的屬，約包含180至200個分類群，廣泛分布全球，並常見於溫帶地區的植被組成。於臺灣植物誌第二版中，本屬共紀錄七個分類群，包含六種與一亞種。本研究於2023年檢視到一份採自宜蘭地區的標本，其形態特徵與臺灣已知的柳葉菜屬物種均不相符。經野外採集、國內外標本比對與文獻考察後，透過葉緣、植株毛被及冬芽等形態特徵，確定本種應為東北柳葉菜之承名亞種(*E. ciliatum* subsp. *ciliatum*)，並將其報導為臺灣新歸化植物，同時提供詳細形態描述與照片、光學顯微鏡與掃描式電子顯微鏡影像、分佈圖，以及臺灣產柳葉菜屬植物之分類檢索表以供鑑定。

材料與方法

本研究於2023~2026年間，於臺灣進行柳葉菜屬植物採集，並檢視植物標本館CHIA, HAST, PPI, TAI, TAIE, TAIF, TCF, TNM與TNU之植物標本。採得的活體植株另外種植於生長箱觀察。本研究使用數位相機拍攝生境與外部形態；使用掃描式電子顯微鏡與TORI

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FOCUS拍攝種子形態；使用光學顯微鏡、掃描式電子顯微鏡與TORI FOCUS拍攝花粉形態。

結果與討論

東北柳葉菜的承名亞種，可透過蒴果上的硬毛(Strigillose hairs)與腺毛數量相近或更多、花序較為開放(Open)、葉狀苞片尺寸較縮減(Reduced)，以及分佈範圍，與其餘兩個亞種區分。東北柳葉菜在葉、花及果實形態上，與臺灣原生的黑龍江柳葉菜(*E. amurense*)、短葉柳葉菜(*E. brevifolium* subsp. *trichoneurum*)相似，但可透過種子表面之縱向紋飾、葉齒牙緣、莖部具自葉柄下延至整個節間的毛稜線、花序與子房密被腺毛、具尺寸較大的蓮座狀冬芽等特徵，來與此兩種區分。本研究2023年時於植物標本館中，僅檢視到一份既有採集紀錄； 2024至2026年間的野外調查中，在臺中梨山福壽山農場周邊開始記錄大量族群，並於宜蘭思源埡口發現少量個體。兩地植株主要生長於道路兩側的受干擾環境，且可觀察到不同生長階段的個體，顯示其族群已能在當地生長與繁衍。由於梨山地區已有多種外來或歸化植物之紀錄，可能隨當地農業活動引入，推測東北柳葉菜也是經由相似途徑進入臺灣。經活體種植觀察發現，本種可自節間長出具根的蓮座狀腋芽，進行營養繁殖，而高種子產量並透過風力傳播亦有利於本種之擴散。本種目前已歸化至歐洲、太平洋島嶼及紐澳地區，甚至被部份研究列為雜草。柳葉菜屬物種間幾乎可相互雜交，尤其本種已有與同屬19個分類群雜交之紀錄；國外亦有觀察到東北柳葉菜逐漸占據並取代原生同屬物種棲地之趨勢。故東北柳葉菜之歸化，可能會對臺灣產柳葉菜屬植物造成棲地競爭及雜交之潛在威脅。綜合其目前野外族群狀況、繁殖與擴散能力，以及在世界各地的歸化紀錄，本研究將東北柳葉菜報導為臺灣的新歸化植物。

結論

於臺灣分佈之東北柳葉菜目前主要被記錄於臺中梨山及宜蘭思源埡口地區，可透過葉緣、植株毛被及冬芽等形態特徵，與臺灣其他近似物種加以區分。本種對臺灣原生植物可能造成的競爭與雜交風險，以及未來是否持續擴散並發展為入侵植物，仍有待未來研究監測。

關鍵詞：柳葉菜屬、新歸化、柳葉菜科、臺灣

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