

A new *Epilobium* (Onagraceae) hybrid: *Epilobium brunnescens* (Cockayne) Raven & Engelhorn × *Epilobium parviflorum* Schreber (*E.* × *argillaceum*)

G. D. KITCHENER

Crown Villa, Otford Lane Halstead, Sevenoaks, Kent, TN14 7EA

ABSTRACT

Epilobium × *argillaceum* Kitchener **hybr. nov.** is described and illustrated. This is a hybrid between a naturalised New Zealand species, *Epilobium brunnescens* (Cockayne) Raven & Engelhorn, and a Eurasian species native to Britain, *Epilobium parviflorum* Schreber. The description is taken from a single plant found in a china clay quarry in East Cornwall, v.c. 2, in 2002.

KEYWORDS: china clay, New Zealand, willowherb.

INTRODUCTION

Epilobium brunnescens (Cockayne) Raven & Engelhorn (New Zealand Willowherb) is well naturalised in the wetter parts of the British Isles, especially in the west and north. Five hybrids with native or other introduced taxa have been recognised (Kitchener & McKean 1998). These are the crosses with *Epilobium ciliatum* Raf., *Epilobium lanceolatum* Sebast. & Mauri, *Epilobium montanum* L., *Epilobium obscurum* Schreber and *Epilobium palustre* L. New Zealand Willowherb hybrids have been found in Northern Ireland and Wales, but there appears to be a particular affinity for mining waste in Cornwall. From this habitat, all these hybrids, except for the cross with *E. palustre*, have been recorded. *Epilobium parviflorum* Schreber (Hoary Willowherb) is also to be found on Cornish mining waste, and so the discovery of a hybrid between this species and *E. brunnescens* was not unexpected.

This is not a hybrid that is likely to occur outside the British Isles, due to the limited distribution of *E. brunnescens* outside New Zealand, and the limited distribution of *E. parviflorum* within New Zealand. While *E. parviflorum* primarily has a Eurasian distribution and is native to Britain, it has been found in New Zealand as an adventive on the North Island, and may be widespread in the eastern parts through the fertile farming country there (Raven & Raven 1976, repeated by Webb *et al.* 1988). Only four records for New Zealand, however, are cited by Raven & Raven, who suppose it to have been introduced not long before the first record, in 1967. *E. brunnescens* in this part of the North Island exhibits a preference for higher ground, at middle elevations, so the New Zealand distribution of the two species is unlikely to coincide to a material degree.

Within the British Isles, the New Atlas of the British and Irish Flora (Preston *et al.* 2002) shows coincidence of distribution of the two species (all records) in 1109 10-km recording squares, primarily in Wales, the Lake District, Northern Ireland and Cornwall.

DISCOVERY

A single hybrid plant was found by the author on 17 July 2002, in the upper parts of Wheal Remfrey china clay works, towards Fraddon Down, and south east of Indian Queens. It was located in a hollow on top of a ridged bank of china clay waste and granite chippings, 5 m high on one side and 10 m on the other. The hollow had apparently remained undisturbed for some time, and vegetation was beginning to establish. In the immediate vicinity of the plant were *E. brunnescens* (5 cm distant), *E. parviflorum* (15 cm), *E. ciliatum* (10 cm) and *E. obscurum* (15 cm). *E. montanum* was in the general vicinity, but not nearby. A colony of 20 plants of *Epilobium* × *brunnatum* Kitchener & McKean and *Epilobium* × *confusilobum* Kitchener & McKean was within 30 m. *E. lanceolatum* was not present, although seen in other china clay quarries.

The china clay area north and north west of St Austell has characteristics that are favourable to *Epilobium* spp., as colonizers of open and disturbed habitats. That includes in particular *E. brunnescens*, which has been noted as typically present there by Margetts & David, 1981, and French *et al.*, 1999. Its establishment on the china clay waste seems to have taken place in the 1940s (Davey 1961).

The area as a whole is dominated by the production, movement and tipping of large quantities of waste sand and gravels deriving from the mining of kaolin, the Hensbarrow deposit at St Austell being the largest in Europe. This is the most intensively tipped location in the UK (Cornwall County Council 1998). Colonization by a permanent flora is slow (Roberts *et al.* 1981), and is inhibited by several factors.

Bradshaw *et al.* (1975) remark that "the sand is almost pure silica: its mineral content is therefore very low indeed", and that "the rainfall of the area is high and evapotranspiration low. This leads to considerable excess rainfall and leaching even during summer months". Storm water run-off carries away the granular sand particles, and "erosion remains active on many of the higher or disturbed tips, with the result that natural colonisation cannot proceed" (Wardell Armstrong 1993). Because the china clay waste retains its open status for so long, pioneer *Epilobium* species have commensurately long opportunities for hybridization. This is in contrast to many disturbed habitats elsewhere, such as felled woodland, which are quickly colonized by *Epilobium* spp. and only remain open for two or three years, with a hybridization window limited to that period.

The plant was distinctive, first as an *E. brunnescens* hybrid, reddish with an upwards curving habit, and secondly because of the hoariness of the stem indumentum. It consisted of four shoots, each curving up to semi-erect position. The tallest was 15 cm high (16 cm long) with damaged tip, the leader and an axillary shoot having apparently been bitten off. The three other shoots were 9 cm high (9.5 cm long), 5.5 cm (8 cm) and 3.5 cm (5 cm). The specimen was taken and grown on until 7 September 2002, in order to provide more flowering and fruiting material, although seed could not be obtained due to sterility, the anthers being indehiscent. In cultivation, the habit became more straggling, and red coloration was limited to stems, but with light bronzing on the underside of the leaves. A cutting was taken which, when rooted, also sent up curving shoots from the lowest nodes. This was over-wintered indoors, when flowering ceased in mid-November, but revived from mid-January into February. The shoots, in lengthening, became prostrate and the reddening of the stems and leaf undersides intensified. Measurements given in the description below are taken from material in both the original and in cultivated state.

DESCRIPTION

Epilobium × *argillaceum* Kitchener, **hybr. nov.**

(*Epilobium brunnescens* (Cockayne) Raven & Engelnhorn × *E. parviflorum* Schreber (Fig. 1)

Hybrida inter *Epilobium brunnescens* (Cockayne) Raven & Engelnhorn et *Epilobium parviflorum* Schreber, characteribus inter parentes variantibus; planta semi-prostrata, stigmata lobis confusis ferens, caulibus pilis abundis et patentibus.

Herb, conspicuously reddish in the wild, less so in cultivated conditions, main stem branched above and with secondary stems emerging at lowest nodes, and curving upwards to erect or semi-erect position, at least to 15 cm high (up to 30 cm high, exceeding 65 cm long in cultivation), flexuous to rigid and up to 1.5 mm diameter, with a dense covering of patent hairs, each generally curving towards the end, often glandular in upper parts, the indumentum being visible without lens and the longest hairs projecting 0.2–0.3(0.35) mm from the stem surface. Leaves opposite below, alternate on the inflorescence, young growth green, then turning reddish except under favourable growth conditions; lowest leaves nearly sessile, others with hairy petioles not exceeding 4.5 mm; cauline leaves 1.1–2.8 mm long, 0.7–1.7 mm wide, ratio of length to breadth ranging from 1:0.52 to 1:0.65, ovate to broadly elliptic with a few teeth; some short crisped hairs on underside, especially on midrib and veins; minutely pubescent on margins; upper leaf surface minutely pubescent, glabrescent with age, generally four lateral veins on either side of midrib. Sepals lanceolate, 3–4 mm long, 0.95–1.2 mm wide, with both short crisped and patent hairs, some

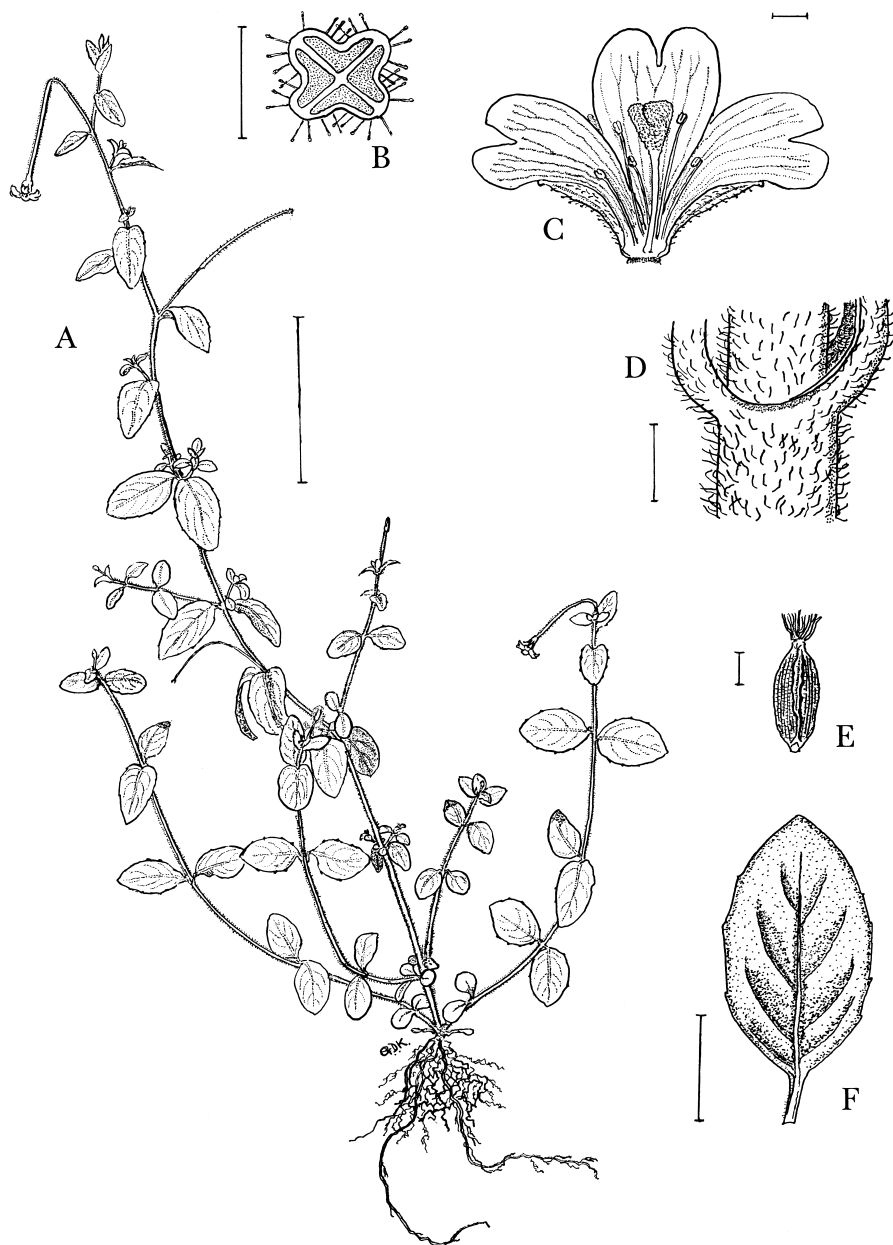


FIGURE 1. *Epilobium x argillaceum*.

Drawing based on material cultivated as a cutting from the original wild plant. A. habit (scale bar 5 cm); B. cross-section of capsule (scale bar 1 mm); C. flower (scale bar 1 mm); D. axil from mid-stem (scale bar 1 mm); E. sterile seed (scale bar 0.1 mm); F. mid-cauline leaf (scale bar 1 cm).

glandular; apical knob prominently red except under favourable growth conditions. Flowers opening to 9(10) mm diameter, with petals (5.5)6.0–7.0(8.0) mm, very pale pink with purple veins. Four long stamens projecting to the level of the stigma; four short stamens below; anthers 0.4–0.6 mm long, 0.25–0.35 mm wide, yellow, indehiscent. Ovary (1.4)1.7–2.1(2.8) cm long, with fairly dense patent glandular hairs, becoming more scattered down the pedicel. Stigma with confused partial lobing; style longer than the stigma. Capsule 1.9–3.1(3.8) cm, generally shriveling up rather than ripening, and containing shrunken abortive seeds 0.30–0.45 mm long.

HOLOTYPE: East Cornwall, v.c. 2, upper part of Wheal Remfrey china clay works, south east of Indian Queens, grid reference SW/925581, on china clay gravels, alt. 160–180 m, 17 July 2002, *G. D. Kitchener, s.n.* (E).

The epithet adopted in naming this hybrid reflects the plant's discovery on the white waste residues of the china clay deposits that dominate the landscape of the St Austell area. The term *argillaceum* – used by Pliny the elder in his *Naturalis Historia* (Mayhoff 1967–70) – is an adjective deriving from *argilla*, meaning white or potter's clay.

DISCUSSION

The hybrid plant shows the influence of New Zealand Willowherb as a parent in its general habit – the prostrate growth of *E. brunnescens*, combined with the erect growth of the second parent, producing a plant whose stems curve upward from an initially semi-prostrate base. The hybrid plant's stigma, with its confused lobing, points to the second parent having a four-lobed stigma (that of *E. brunnescens* being clavate). The only *Epilobium* species in the vicinity possessing a four-lobed stigma were *E. montanum* and *E. parviflorum*.

E. montanum may be discounted as a potential parent on account of its stem hairs. These are generally short and crisped, sometimes with an admixture of glandular hairs in the upper parts. In the cross of this species with *E. brunnescens* (*E. × confusilobum*) the stem hairs are close-set, crisped and near appressed, so that they scarcely stand out from the stem – not more than 0.05 mm.

E. parviflorum bears patent stem hairs, which may be straight or bent in various directions in a tangled manner, and often in considerable quantity so as to give a soft hoary appearance to the stem, and these hairs may project from 0.8 mm to 1.25 mm from the stem surface. In the upper parts, there is an admixture of glandular hairs. One would accordingly expect a hybrid with *E. brunnescens* to reflect these characteristics, tempered by the influence of *E. brunnescens*, whose stems are glabrous, or with some minute pubescence. The Indian Queens plant does so by exhibiting numerous patent stem hairs, both straight and bent in various directions, the longest of which project from 0.2 mm to 0.3 mm (to 0.35 mm in cultivation) from the stem surface, and there are numerous glandular hairs in the upper parts.

While the absence of *E. lanceolatum* from the vicinity suggests that this species may be discounted as a parent, although it bears a four-lobed stigma, it is also possible to discount this on morphological grounds. The stem hairs of *E. lanceolatum* are fairly similar to those of *E. montanum*, short and crisped, occasionally longer and glandular. In the cross of this species with *E. brunnescens* (*E. × cornubiense* Kitchener & McKean), the stem hairs are similar to those of *E. × confusilobum*, close-set, crisped and near appressed, so as to stand out no more than 0.05 mm from the stem. Accordingly, *E. lanceolatum* may be discounted as a potential parent, in much the same way as *E. montanum*.

CONCLUSION

This find provides further evidence of the potential for hybridization between Australasian and European species of *Epilobium*, including between prostrate and erect taxa, demonstrated experimentally by Brockie (1970), and with natural occurrences in the British Isles described by Kitchener & McKean (1998), McKean (1999) and Holyoak & Kitchener (2001).

With the discovery of this hybrid, there have now been found crosses of *E. brunnescens* with all British *Epilobium* species with which it may commonly grow together, except for *E. hirsutum* L.

Other less frequently sympatric species include *E. tetragonum* L., although its distribution is related to the drier lowland parts of the British Isles, and bears limited coincidence with the distribution of *E. brunnescens*, which favours wetter and upland areas. The data in Preston *et al.* (2002) show both species (all records) as having been present in 284 10-km recording squares, although this requires the caveat that proximity within those 10-km squares is not necessarily implied. The potential overlap of distribution with *E. roseum* Schreber is also limited, with 342 recording squares, which probably overstates the position, because of the greater proportion of historic records. Attempts to synthesize the cross between *E. brunnescens* and *E. roseum* have failed due to slow pollen tube growth (Thakur 1965), but as the same sequence of experiments was unsuccessful with *E. brunnescens* × *montanum* which has occurred naturally, then it should not be assumed that an *E. roseum* hybrid is impossible.

Although the habitat preferences of the montane species *E. alsinifolium* Villars and *E. anagallidifolium* Lam. may apparently offer opportunity for co-location with *E. brunnescens*, and there is a high level of coincidence at 10-km recording square level, their relative scarcity limits the possibilities for further New Zealand Willowherb hybrid combinations in the wild in the British Isles.

REFERENCES

- BRADSHAW, A. D., DANCER, W. S., HANDLEY, J. F. & SHELDON, J. C. (1975). *The biology of land revegetation and the reclamation of the china clay waste of Cornwall*, in CHADWICK, M. J. & GOODMAN, G. T., eds., *The Ecology of Resource Degradation and Renewal*, pp 363–384, Blackwell Scientific Publications, Oxford.
- BROCKIE, W. B. (1970). Artificial hybridisation in *Epilobium* involving New Zealand, European and American species. *New Zealand journal of botany* **8**: 94–97.
- CORNWALL COUNTY COUNCIL (1998). *Cornwall Minerals Local Plan*, Cornwall County Council, Cornwall.
- DAVEY, A. J. (1961). Biological Flora of the British Isles: *Epilobium nerterioides* A. Cunn. *Journal of Ecology* **49**: 753–759.
- FRENCH, C. N., MURPHY, R. J. & ATKINSON, M. G. C. (1999). *Flora of Cornwall*, Wheal Seaton Press, Camborne.
- HOLYOAK, D. T. & KITCHENER, G. D. (2001). *Epilobium* × *kitcheneri* McKean (Onagraceae) in East Cornwall. *Watsonia* **23**: 452–453.
- KITCHENER, G. D. & MCKEAN, D. R. (1998). Hybrids of *Epilobium brunnescens* (Cockayne) Raven & Engelhorn (Onagraceae) and their occurrence in the British Isles. *Watsonia* **22**: 49–60.
- MARGETTS, L. J. & DAVID, R. W. (1981). *A Review of the Cornish Flora 1980*. Institute of Cornish Studies, Redruth.
- MAYHOFF, C. ed. (1967–70). *C. Plinius Secundus Naturalis Historia*, B. G. Teubner, Stuttgart.
- MCKEAN, D. R. (1999). A new *Epilobium* hybrid from Scotland, *E. pedunculare* A. Cunn. × *E. montanum* L. *Watsonia* **22**: 417–419.
- PRESTON, C. D., PEARMAN, D. A. & DINES, T. D. (2002). *New Atlas of the British and Irish Flora*, Oxford University Press, Oxford.
- RAVEN, P. H. & RAVEN, T. E. (1976). The genus *Epilobium* (Onagraceae) in Australasia: a systematic and evolutionary study. *New Zealand Department of Scientific and Industrial Research Bulletin* 216, Christchurch, New Zealand.
- ROBERTS, R. D., MARRS, R. H., SKEFFINGTON, R. A., & BRADSHAW, A. D. (1981). Ecosystem development on naturally-colonized china clay wastes. 1. Vegetation changes and overall accumulation of organic matter and nutrients. *Journal of Ecology* **69**: 153–161.
- THAKUR, V. (1965). *Biosystematics of some species of Epilobium*. Unpublished PhD thesis, University of Durham.
- WARDELL ARMSTRONG (1993). Landscaping and revegetation of china clay waste – main report. Department of the Environment.
- WEBB, C. J., SYKES, W. R. & GARNOCK-JONES, P. J. (1988). *Naturalised pteridophytes, gymnosperms, dicotyledons*. *Flora of New Zealand* 4. Botany Division, Department of Scientific and Industrial Research, Christchurch, New Zealand.

(Accepted April 2003)