

## Conservation of Britain's biodiversity: Status of the rare English endemic *Hieracium mammidens* (Breast-toothed Hawkweed; Asteraceae)

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### Abstract

*Hieracium mammidens* P.D.Sell, Breast-toothed Hawkweed, is a rare South-east England endemic. Common garden experiments showed that minor differences between populations at Waltham Park and Caesar's Camp are not sufficient to recognise separate taxa. Excision of florets on five plants showed that seed is produced in similar amounts to control heads, thus demonstrating it is apomictic. A survey of all sites in 2024 found 162 plants in four populations; it was not refound in seven sites and is unconfirmed in another four sites. It is IUCN Threat Status 'Endangered'.

**Keywords:** apomixis; IUCN threat status

### Introduction

*Hieracium mammidens* P.D.Sell, Breast-toothed Hawkweed, is a rare English endemic only known from a few sites in South-east England (McCosh & Rich, 2018; Shaw, 2020). It was first described by Sell & Murrell (2006) and relatively little is known about it except for data gleaned from herbarium specimens and some field work. The late Mike Shaw was particularly interested in *H. mammidens* and, during the production of his excellent *Hawkweeds of South-east England* (Shaw, 2020), expressed concern to me that plants from Waltham Park (v.c.13) differed from those at Caesar's Camp (v.c.12) and the holotype from Pembury (v.c.16) in having smaller leaf teeth and only two or sometimes three stem leaves (*cf.* Shaw's (2020) Figs. 234-236 on pages 135-136, and pers. comm. 2019). He was unsure if the variation was of genetic or environmental origin and whilst he had grown plants from Waltham Park in open conditions in his garden and found they grew six stem leaves and had more typical large mammiform teeth (herb. M.M. Shaw in **BM**), these plants had not been compared with plants from Caesar's Camp cultivated under the same conditions. I have now cultivated material from both sites to resolve this issue, and the aim of this paper is to present the results of this common garden experiment coupled with a field survey of all sites in May 2024 to give an updated IUCN (2001) conservation assessment for this rare endemic.

*Hieracium mammidens* is a member of *Hieracium* section *Vulgata* (Griseb.) Willk. & Lange. It is characterised by having broad, unspotted rosette leaves with

mammiform teeth, 3-5 stem leaves, peduncles with numerous glandular and simple hairs, obtuse involucre bracts up to c.11 mm long and up to 1.5 mm wide, with numerous glandular hairs and fewer simple and stellate hairs (the latter mainly on the margins), hairy-tipped ligules in bud and yellow styles (Sell & Murrell, 2006; Shaw, 2020). For differences from similar hawkweeds in South-east England, see Shaw (2020).

## Methods

### *Common garden experiments*

Seeds were collected from the Waltham Park and Caesar's Camp populations in June 2021. They were labelled and sown separately in the same tub of soil on John Innes no. 2 peat-free potting compost and grown in sunny conditions in my Cardiff garden with regular watering. The plants were compared at peak flowering the following year on 17 June 2022 using a range of characters. Vouchers were collected in 2022 and 2023 and have been deposited in **K** and **NMW** respectively.

### *Test for apomixis*

Sell & Murrell (2006) stated that *H. mammidens* was apomictic, but this was assumed rather than tested experimentally (as for the vast majority of taxa they cite as apomictic).

Examination of recently opened florets showed that lots of pollen was produced, so florets were excised before they were mature and the pollen released. On 19/5/2024, shortly after plants had come into flower, one capitulum in bud on each of five different cultivated plants (4 from Waltham Park, 1 from Caesar's Camp) had florets excised with a scalpel to just below the anther ring, and was labelled and left to develop. For practicality, the bracts were also cut to the same length as the florets. As it is not easy to excise the florets to exactly the right distance, the developing excised ligules were checked as they developed; additional trimming was required on two of the five excised capitula. One capitulum on each plant was labelled and left to develop normally as a control. Plants were grown on inside the house in the absence of pollinators. Once mature, opened seed heads were examined for well-formed seeds which are typically 2.8-3.2 mm long x 0.6-0.7 mm wide and dark blackish-brown at maturity (undeveloped seeds were shorter, thinner, were easily bent with tweezers and were often brownish-red). Seed viability was tested by sowing on damp soil in a greenhouse and assessing presence of at least some germination after two weeks.

### *Distribution and habitats*

Records were compiled from herbaria (**BM**, **CGE**, **MNE**, **NMW**, **SLBI**, herb. **D. McCosh**), D. McCosh's *Hieracium* database, the BSBI database and the literature. The data were reviewed indicating 11 confirmed sites supported by specimens and four unconfirmed sites without specimens. The records are listed in Appendix 1 and were used to direct the field work.

All sites were visited 29-31 May 2024, at a time when fewer other hawkweeds would be in flower to make finding *H. mammidens* easier. Once populations were found, flowering and vegetative plants were counted and associated species within c.50 cm were noted with DAFOR frequency. Soil pH was measured in a 50:50 slurry

of soil with tap water using a calibrated Preciva ATC pen pH meter (model PH320001).

### *Conservation status*

Conservation status was assessed following the version 3.1 IUCN (2012) criteria. Only flowering plants were assumed to be mature when assessing effective population size.

## **Results**

### *Common garden experiments*

Plants from Caesar's Camp and Waltham Park grew well in cultivation (Fig. 1) and in Table 1 are compared to the holotype and to wild plants from the same sites (**BM**, **CGE**). The small numbers of plants examined does not allow for robust statistical analysis.

Both wild and cultivated plants Caesar's Camp and Waltham Park differ slightly from the holotype but in general all the plants fitted the description in Sell & Murrell (2006) reasonably well though the bracts were found to be up to 1.5 mm wide, much wider than the 0.8-1.0 mm cited by Sell & Murrell (2006) and by Shaw (2020). The peduncles of lateral branches always had more hairs than the acadium.

In cultivation the overall differences between the populations were minor. The Caesar's Camp plants grew taller than wild plants, but otherwise looked much the same, and the Waltham Park plants grew much taller compared to the wild plants with double the number of stem leaves and bigger leaf teeth, as reported by Shaw (2020). When cultivated plants from Caesar's Camp and Waltham growing in the same conditions were compared (the key comparison), overall the Waltham Park plants were slightly taller, with more, slightly narrower stem leaves, and had involucre bracts slightly darker and longer, with more glandular hairs.

**Table 1. Comparison of plants of *H. mammidens* from Caesar's Camp and Waltham Park cultivated under the same conditions.**

Character	Pembury (Holotype)	Caesar's Camp		Waltham Park	
Origin	Wild	Wild	Cultivated	Wild	Cultivated
No. plants	1	3	4	6	7
Height	68 cm	40-45 cm	23-60 cm	28-56 cm	30-67 cm
Stem leaves	6, to 8 x 4.5 cm, elliptic to obovate	2-6, to 8 x 4 cm, obovate, elliptic, ovate or lanceolate	3-5, to 7 x 4.5 cm, ovate	2(-3), to 9 x 4.5 cm, elliptic to lanceolate	4-6, to 8 x 3 cm, lanceolate
Peduncles - glandular hairs	Numerous	Frequent	Very few	Numerous	Frequent
Peduncles - simple eglandular hairs	Scattered	Sparse to frequent	Very few	Frequent	Frequent
Involucral bracts length and width	To 11 mm long x 1.3-1.4 mm wide	To 9 mm long x 0.8-1.2 mm wide	To 10 mm long x 1.2-1.5 mm wide, slightly paler overall	To 10 mm long x 1.2-1.4 mm wide	To 11 mm long x 1.3-1.5 mm wide, slightly darker overall
Involucral bracts - glandular hairs	Numerous	Numerous	Numerous, mostly 0.25-0.4 mm	Numerous	Numerous, mostly 0.3-0.4 mm
Involucral bracts - simple eglandular hairs	Scattered	Frequent	Absent or few, or varying on same plant	Numerous	Sparse
Involucral bracts - stellate hairs	Sparse on margins when young	Few on lowest bracts	Very few	Few on lowest bracts	± Absent



**Figure 1. Cultivated plants of *H. mammidens* from Caesar's Camp (left side) and Waltham Park (right side) grown in same tub of soil in Cardiff, 2022.**

### *Test for apomixis*

The first excised capitulum ripened on 2 June 2024 followed by the others over the next five days. The capitula were collected and examined for well-formed seeds (Table 2). Some undeveloped seeds were found in all heads, irrespective of whether excised or not, and one control capitula failed to set any viable seed at all though other heads on the same plant set seed normally. A t-test (excluding the incompletely sampled excised head and the sterile control head) showed that there is no significant difference in % seed set between excision and control treatments ( $p=0.6098$ ), thus demonstrating it to be apomictic.

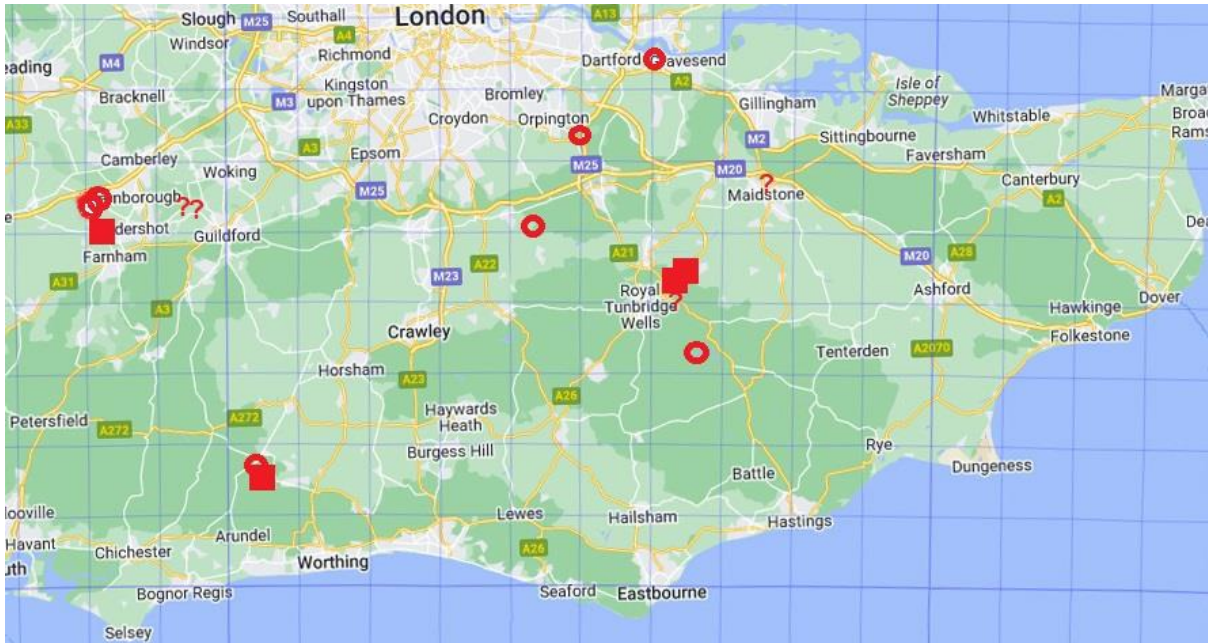
Seed germination was assessed after two weeks and some seed from all excision treatments and a bulked control sample was observed growing, showing the seeds are viable.

**Table 2. Seed production in excised and control heads of *H. mammidens***

<b>Treatment</b>	<b>Plant</b>	<b>Seed production</b>
Excised	Waltham Park 1	23 well-formed seeds, 1 undeveloped
	Waltham Park 2	6 well-formed seeds, 15 undeveloped
	Waltham Park 3	23 well-formed seeds, 17 undeveloped
	Waltham Park 4	27 well-formed seeds, 12 undeveloped
	Caesar's Camp 1	2 well-formed seeds; remainder of seedhead fell before seeds could be collected
Control	Waltham Park 1	36 well-formed seeds, 11 undeveloped
	Waltham Park 2	33 well-formed seeds, 11 undeveloped
	Waltham Park 3	0 well-formed seeds, 37 undeveloped; other heads on this plant produced normal fertile seed
	Waltham Park 4	25 well-formed seeds, 19 undeveloped
	Caesar's Camp 1	29 well-formed seeds, 10 undeveloped

### *Distribution*

Full details of the results of the field survey were compiled into an unpublished report (Rich, 2024) which is available on request to researchers. The data are mapped in Figure 2, summarised in Table 3 and discussed for each site below.



**Figure 2. Distribution map of *Hieracium mammidens*. ■ 2024. ○1898-2023. ? Site unconfirmed.**

**Table 3. Summary results from field survey in 2024**

v.c.	Locality	Last record	Flower-ing	Vegeta-tive	Total
12	Caesar’s Camp (5 subpopulations)	2024	90	51	141
12	Fleet	1898			0
12	Fleet, Church Road	2011			0
13	Fittleworth Station	1902			0
13	Waltham Park	2024	2	2	4
14	Lower Cousley Wood/ Cousley Wood	1953			0
16	Colt’s Hill	2024	9	2	11
16	Crockham Hill	1957			0
16	Parkwood, Swanley	1945			0
16	Pembury				0
16	Pembury Hall/Kent College/ Kenward subpopulation 1	2024	5	1	6
16	Swanscombe	1983			0
		<b>total</b>	<b>106</b>	<b>55</b>	<b>162</b>
<b>Unconfirmed sites</b>					
15/16	Maidstone	1972			0
17	Brookwood to North Camp	1898			0
17	Pirbright	1898			0
16	Pembury Hall/Kent College/ Kenward subpopulation 2	2024		12	

#### Caesar's Camp (v.c.12 North Hampshire)

Plants were first found at this site in two subpopulations in 2011 by A.R.G. Mundell. In 2017, M. Shaw noted that the colony had declined (Shaw, 2020). Seeds were collected for the Millennium Seed Bank in 2021 (Rich, 2023).

On 29 May 2024, 139 (88 flowering, 51 vegetative) plants were found in five subpopulations associated with the scarp in the NE corner of the camp on sand and flint heath. Plants were quite varied in height, number of stem leaves and number of capitula. Associated species included *Avenella flexuosa* (Frequent), *Calluna vulgaris* (Frequent), *Erica cinerea* (Frequent), *Festuca ovina* (Occasional), *Hypochaeris radicata* (Occasional), *Jasione montana* (Occasional), *Pteridium aquilinum* (Frequent), *Rubus fruticosus* (Frequent), *Rumex acetosella* (Frequent), *Solidago virgaurea* (Occasional), *Teucrium scorodonia* (Occasional), *Ulex europaeus* (Locally Abundant) and *Vaccinium myrtillus* (Frequent), with a varied open canopy of *Betula pendula*, *Castanea sativa*, *Quercus cerris* and *Pinus* cf. *nigra*. Two more plants were found by A.R.G. Mundell & the Hants Flora Group on 6 July about 250 m to the south-west.

#### Fleet (v.c.12 North Hampshire)

It was recorded once on sandy banks near Fleet in 1898 by E.S. Marshall but was not more precisely localised to enable refinding.

#### Church Road, Fleet (v.c.12 North Hampshire)

In 2011, A.R.G. Mundell found it at the south-east end of Church Road, Fleet in a large mixed colony of hawkweeds (this was presumably a different site to Marshall's as Church Road was already built). It was not refound in Church Road by T. Rich & J.C. Rich on 25 June 2021 (Rich, 2023) or on 29 May 2024 though at least five other *Hieracium* species were present.

#### Fittleworth Station (v.c.13 West Sussex)

It was first reported from Fittleworth Station in 1902 by E.S. Marshall with specimens variously labelled 'on clayey banks by', 'close to' and 'by the railway' (**BM**, **CGE**). Shaw (2020) could not refind any plants at the station (now a private dwelling), and no plants were refound on roadsides or adjacent woodlands on 31 May 2024.

#### Waltham Park (v.c.13 West Sussex)

This site was first found by F. Abraham in 2011 and has been seen regularly on the roadside bank since (Shaw, 2020). Seed was collected in 2021 when there were 17 plants (Rich, 2023) but on 31 May 2024 only four plants were found (2 flowering, 2 vegetative). Associated species included *Hedera helix* (Occasional), *Lathyrus linifolius* (Occasional), *Luzula forsteri* (Abundant), *Melica uniflora* (Frequent), *Primula vulgaris* (Frequent), *Prunella vulgaris* (Occasional), *Pteridium aquilinum* (Occasional), *Veronica chamaedrys* (Occasional) and *Viola riviniana* (Occasional) and the roadside bank was heavily shaded by *Thuja plicata*.

#### Lower Cousley Wood/Cousley Wood (v.c.14 East Sussex)

One site or possibly two different sites were found at Lower Cousley Wood in 1943 (**SLBI**) and at Cousley Wood in 1953 (**BM**, **herb. McCosh**). The area was searched



by M. Shaw in 2017 without success (Shaw, 2018, 2020). Lane sides and wood margins were searched on 30 May 2024, again without success.

#### Colt's Hill (v.c.16 West Kent)

It was collected at Colt's Hill crossroads in 1957 by F.R. Browning (**CGE**). Eleven plants (9 flowering, 2 vegetative) were refound on 30 May 2024 on Crittenden Road. Associated species included *Brachypodium sylvaticum* (Occasional), *Melica uniflora* (Frequent), *Poa nemoralis* (Frequent) and *Stellaria holostea* (Abundant) under a canopy of *Castanea sativa*.

#### Crockham Hill (v.c.16 West Kent)

It was collected at Crockham Hill in 1957 by C. West (**MNE**). The Crockham Hill area was searched on 29 May 2024 without success, and it was not clear where it may have occurred, the most likely place being Crockham Hill Common but this is now dense woodland; Crockham Hill itself has no obvious places.

#### Maidstone (v.c.15,16 Kent)

Listed for Maidstone in 1972 by Philp (2010) but no specimens have been seen and there are no details in Eric Philp's card index which has a blank index card (G. Kitchener, pers. comm. 2024). As this record lacks any details it is regarded as unconfirmed and was not searched for.

#### Pembury (v.c.16 West Kent)

The holotype is labelled simply 'Pembury' and may relate to Pembury village itself or the following site just to the north. Pembury was searched by M.M. Shaw in 2017 without success (Shaw, 2020), and there were no obvious places in the village to search in 2024 either.

#### Pembury Hall/Kent College/Kenward (v.c.16 West Kent)

The four records between 1953 and 1959 appear to relate to two subpopulations on Pembury Hall Road.

It was refound on Pembury Hall Road by T. Rich & G. Kitchener on 31 May 2024; 6 plants (5 flowering, 1 vegetative) occurred on the east bank opposite a recently coppiced chestnut wood associated with *Avenella flexuosa* (Occasional), *Digitalis purpurea* (Frequent), *Dryopteris dilatata* (Occasional), *Hedera helix* (Occasional), *Holcus lanatus* (Occasional), *Hyacinthoides non-scripta* (Abundant), *Luzula forsteri* (Occasional) and *Teucrium scorodonia* (Occasional) under a canopy of *Ilex aquifolium* and *Quercus robur*.

A second possible subpopulation of 12 small vegetative plants was found near Kenward in deep shade in old chestnut coppice; it is very likely that these are *H. mammidens* but in their shaded vegetative state cannot be confirmed.

#### Parkwood, Swanley (v.c.16 West Kent)

It was collected at 'Parkwood', Swanley by F.R. Browning in 1945 (**herb. McCosh**). The area was searched on 30 May 2024 without success. Parkwood itself is now Parkwood Hall Co-operative Academy, a private school with no access. The adjacent Beechenlea Lane was heavily shaded through Parkwood, but lightly shaded and more suitable to the north.

Swanscombe (v.c.16 West Kent)

It was collected at Swanscombe by J.R. Palmer in 1983 (**MNE**; Philp, 2010). John Palmer's notebooks indicate that he was recording tetrad TQ67C and he noted *H. pollichiae* and *H. diaphanum* in the chalkpit NW of Swanscombe (G. Kitchener, pers. comm. May 2024).

The Swanscombe area was searched on 30 May 2024 without success. There are two chalk pits NW of Swanscombe within tetrad TQ67C, neither of which had access so other industrial areas and waste ground were checked in case plants had spread elsewhere.

Brookwood to North Camp and Pirbright (v.c.17 Surrey)

E.S. Marshall noted on an 1898 Fleet *H. mammidens* specimen in **BM** "I have exactly the same plant from Pirbright and the railway banks between Brookwood and North Camp". Other plants collected from the railway banks by E.S. Marshall in 1898 have been determined as *H. anglorum* (**CGE**) and *H. consociatum* (**NMW**).

Possible areas were searched on 29 May 2024 but no *H. mammidens* was found though there is still some suitable habitat along the railway. In the absence of specimens, these two sites remain unconfirmed.

#### *Habitats*

The most typical habitat is a roadside bank, which may be open or partly shaded or at least periodically open when associated with woodland management such as coppicing. In terms of the British Plant Communities (Rodwell, 1991a), the Waltham Park, Colts' Hill and Pembury Park Road sites occupy specific open niches within what are broadly W10 *Quercus robur*-*Pteridium aquilinum*-*Rubus fruticosus* woodlands. The Caesar's Camp vegetation is more like open heathland in character, but is a mix of young W16 *Quercus* spp.-*Betula* spp.-*Deschampsia flexuosa* woodland, W23 *Ulex europaeus*-*Rubus fruticosus* scrub and scrappy H2b *Calluna vulgaris*-*Ulex minor* heath, *Vaccinium myrtillus* sub-community (Rodwell, 1991a, 1991b). It has also been recorded on urban roadside and railways. The Swanscombe chalk quarry habitat is atypical.

With the exception of the Swanscombe chalk quarry, the sites are mostly on mildly acidic sand and gravels over sandstones, or rarely on clay soils over Gault Clay (British Geological Survey, 2023; Table 4).

**Table 4. Geology and soils at confirmed sites (British Geological Survey, 2024).**

<b>Site</b>	<b>Geology</b>	<b>Main soil type</b>
Caesar's Camp	Camberley Sand Formation overlain by Caesar's Camp Gravel Formation	Mixed flint, gravel and sandy soil pH 4.3 with some clays pH 4.8
Colt's Hill	Tunbridge Wells Sand Formation	Sandy clays on side of road cutting
Crockham Hill	Hythe Formation	Probably loams derived from superficial deposit of clay, silt, sand and gravel.
Fittleworth Station	Gault Formation	Clay to clayey loams
Fleet	Camberley Sand Formation	Sands

Lower Cousley	Tunbridge Wells Sand Formation	Clay to clayey loams
Parkwood, Swanley	Thanet Formation	Sands
Pembury	Tunbridge Wells Sand Formation	Sandy to clayey loams, pH 3.7-3.9
Swanscombe	Chalk	[Quarry]
Waltham Park Road	Gault Formation	Clay to clayey loams, pH 6.2

### *Conservation status*

The field survey found 106 mature plants in four sites with an Area of Occupancy estimated to be *c.*1600 m<sup>2</sup> with a highly fragmented distribution within an Extent of Occurrence estimated to be 149 km<sup>2</sup>. It was not refound in seven sites, and four sites remain unconfirmed. From the fragmentary data based on *ad hoc* historic data, the loss of sites (Table 3) has generally been ongoing for the last 120 years. It is not known how long plants live for to calculate rates of population decline, but the Waltham Park site has declined recently as has the first subpopulation at Caesar's Camp.

Under the IUCN (2012, version 3.1), *H. mammidens* thus qualifies as Threat Status 'Endangered' under Criterion B1a,b(v) with an Extent of occurrence estimated to be less than 5,000 km<sup>2</sup>, plants known to exist at fewer than five locations and a continuing observed decline in the number of mature individuals, and under Criterion D population size estimated to number fewer than 250 mature individuals.

### **Discussion**

The common garden experiment shows that the variation in leaf tothing and number of stem leaves observed in the field by Shaw (2020) was primarily due to environmental conditions. The Caesar's Camp population occurs in open scrub/heathland on a gentle, north-facing slope on free-draining flint and sand soil derived from riverine deposits. The Waltham Park population occurs on a heavily shaded, south-facing roadside bank in woodland on clay to clayey loams derived from the Gault Clay. Once cultivated under the same conditions, these two characters show no significant differences.

The common garden experiment however shows that there are other minor differences between the populations in leaf width, peduncle hairs, and involucrel bract size and hairs. These differences show that the populations are slightly different, but are not considered sufficient enough to merit distinguishing them as separate taxa. These differences are likely to be due to local genetic drift in the fragmented populations of an apomictic species (the apomixis now confirmed by the excision experiments).

The 'Endangered' *H. mammidens* currently has no protection. It is recommended that *H. mammidens* should be given statutory protection at Caesar's Camp (the population is currently within a statutorily protected site, Bourley and Long Valley SSSI, but is not listed on the reasons for designation), Waltham Park and Pembury. The Colt's Hill crossroads site would be very difficult to protect and

manage. Regular monitoring should be carried out to ensure the populations are maintained.

Seed from Caesar's Camp, Waltham Park and Pembury Hall Lane have been deposited in the Millennium Seed Bank.

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## Appendix 1 Summary of all records of *H. mammidens*

Herbarium material in **CGE** was determined by P.D. Sell, with other material determined by D. McCosh.

### *v.c.12 North Hants*

Caesar's Camp (SU8350, two adjacent populations). Population 1: A.R.G. Mundell, 22 May 2011, 61 plants (**BM, NMW**; Shaw, 2020); T.C.G. & J.C. Rich, 25 June 2021, 34 plants (Rich, 2022). Population 2: A.R.G. Mundell, 22 May 2011, 30 plants (**BM**); A.R.G. Mundell, about 30 plants, 30 April 2012 (**NMW**); M. Shaw, 18 July 2017, three plants (Shaw 2020). T.C.G. & J.C. Rich, 25 June 2021, 2 plants (Rich, 2022).

Fleet, sandy banks near [SU85], E.S. Marshall, 17 June 1898 (**BM, CGE, NMW**). Fleet, Church Road, SU807545, A.R.G. Mundell, 22 May 2011, a large mixed colony of *H. sylvularum*, *H. koehleri*, *H. exotericum* agg., *H. grandidens* and *H. mammidens* (**herb. D. McCosh**).

### *v.c.13 West Sussex*

Fittleworth Station, variously labelled 'on clayey banks by', 'close to' and 'by the railway' [TQ0118], E.S. Marshall, 3 May 1902 grown on until 9 June 1902 (**BM, CGE**).

Waltham Park Road (also reported as Fittleworth, Coldwaltham, etc.), TQ0016. F. Abraham, 3 May 2011. M.M. Shaw, 16 June 2012, over about 20 m on a shady bank (**BM**). M.M. Shaw, 11 June 2013 (**BM**). M.M. Shaw, 21 June 2016 (**BM**). M.M. Shaw, 6 June 2018 (**BM**). M.M. Shaw & B. Burrow, 18 June 2019 (**BM**). 26 June 2021, T.C.G., J.C. & J.P. Rich, 17 plants (**K**).

### *v.c.14 East Sussex*

Lower Cousley Wood, lane near [TQ6533 assumed], J.R. Wallis, 13 June 1943 (**SLBI**, material not seen). Cousley Wood, F.R. Browning, 23 June 1953 (**BM, herb. McCosh**).

### *v.c.16 West Kent*

Colt's [Hall] Hill crossroads, between Capel and Matfield [TQ6443 assumed], F.R. Browning, 21 May 1957 (**CGE**). Crittenden Road, just east of junction with A228, half a dozen plants, G. Kitchener, 29 May 2019 (field record).

Crockham Hill, Westerham (TQ4352), C. West, 25 June 1957 (**MNE**).

Pembury, TQ6240, C. West, 7 June 1956 (**CGE** holotype, **MNE**). C. West, July 1957 (**MNE**). C. West, July 1959 (**CGE**).

Kenward, bank [TQ6243], F.R. Browning, 5 June 1953 (**BM**). C. West & P.D. Sell, 1953 (**BM**). Kenwood, shady hedgebank, B.A. Miles, 30 June 1958 (**CGE**).

Bank between Pembury Hall and Kent College, North Lodge [TQ622430], F.R. Browning, 29 May 1956 (**BM**).

Maidstone, 1972 (Philp, 2010), no material seen, v.c.15 or 16 uncertain.

Swanley, 'Parkwood' [TQ5268 assumed], F.R. Browning, 26 May 1945 (**herb. McCosh**).

Swanscombe TQ6074, J.R. Palmer, 25 May 1983 (Philp, 2010; **MNE** but material not currently in herbarium folder, P. Richards, pers. comm. 2024).

*v.c.17 Surrey*

E.S. Marshall noted on one 1898 Fleet specimen in **BM** "I have exactly the same plant from Pirbright and the railway banks between Brookwood and North Camp". This site is unconfirmed.