
Cuscuta epithymum (L.) L. (Convolvulaceae), Its Hosts and Associated Vegetation in a Limestone Pavement Habitat in the Burren Lowlands in County Clare (H9), Western Ireland
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CUSCUTA EPITHYMUM (L.) L.
(CONVOLVULACEAE), ITS HOSTS AND
ASSOCIATED VEGETATION IN A
LIMESTONE PAVEMENT HABITAT IN THE
BURREN LOWLANDS IN COUNTY CLARE
(H9), WESTERN IRELAND

G. J. Doyle

ABSTRACT

Cuscuta epithymum (L.) L. (common dodder) has been found growing in a limestone pavement habitat in the Burren Lowlands (H9) in County Clare, western Ireland. The species is relatively rare in Ireland and is confined to sixteen coastal vice-counties. On limestone pavement *Cuscuta* is found in vegetation belonging to the *Asperulo-Seslerietum*, an association assigned to the chalk grassland class *Festuco-Brometea*. The vegetation of the limestone pavement habitat is compared with mature dune grassland at Fanore, also in the Burren region, where extensive populations of *Cuscuta* occur in vegetation assigned to the *Camptothecio-Asperuletum*, another association belonging to the same class. While there are species differences between the communities in these contrasting habitats, there is considerable floristic overlap. *Cuscuta epithymum* is catholic in its selection of host plants at these sites. The hosts common to the two sites include *Achillea millefolium*, *Lotus corniculatus*, *Thymus praecox*, *Asperula cynanchica*, *Trifolium pratense* and *Viola* species. There are fourteen additional hosts on the limestone pavement, and fifteen confined to the mature dune grassland site. Despite the catholicity of host selection, the rarity of *Cuscuta* in Ireland suggests that establishment is a critical determinant of the species' distribution, and depends on the initial infection of a primary host in an appropriate habitat with suitable environmental conditions.

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INTRODUCTION

Parasitic *Cuscuta epithymum* (L.) L. (common dodder) is, in Ireland, confined to coastal regions: the plant is now recorded in sixteen vice-counties (Scannell and Synnott 1987). The species was previously located in Meath (H22) but there are no modern records for the plant in that vice-county. *Cuscuta epithymum* is widely distributed on the European mainland and in the south-east part of Britain (Fig. 1), but is absent from much of the west and north of Britain and is confined to the southern parts of Fennoscandia (Perring and Walters 1976; Meusel *et al.* 1978; Hultén and Fries 1986).

In north-west Europe, *C. epithymum* is mainly associated with heathland vegetation belonging to the *Calluno-Ulicetea* Br.-Bl. et Tx. 1943, particularly the gorse heaths of the *Ulicetalia minoris* (Duvign. 1944) Géhu 1973 (Tüxen 1970; Gimingham 1972; Westhoff and Den Held 1975; Oberdorfer 1979; Rieley and Page 1990; Rodwell 1991). On mainland Europe *C. epithymum* is also

associated with acid 'grass-heathlands' of the *Nardo-Galion* Prsg. 1949, and dry calcareous grasslands of the *Festuco-Brometea* Br.-Bl. et Tx. 1943 (Rothmaler 1976).

Webb (1977) considers *C. epithymum* a very rare plant in Ireland and states that it is distributed on sandy ground near the sea and mainly in the southern half of the island. While Scannell and Synnott (1987) consider the species a native of sand-dunes in Ireland, Webb and Scannell (1983) and Nelson (1991) suggest that there is no place in Ireland where this plant is undoubtedly native.

A relatively well-documented site for *C. epithymum* is at Fanore in the Burren, the karstic region of north-west County Clare on the Irish west coast (Fig. 2). *Cuscuta* was first found in that area by Druce (1909) 'in pasture about a mile [1.6km] south of Black Head'. Specimens lodged in the herbarium at the National Botanic Gardens at Glasnevin, Dublin, by A. W. Stelfox in 1924 were found near the Caher River at 'Murrrough' (Murrrough), about 3.4km south of Black Head.

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Further specimens were collected from Fanore dunes by Dr P. O'Connor in 1934. Some years later, Webb (1947) recorded the plant at Fanore 'on the edge of the sand-dunes that lie immediately to the north of the mouth of the Caher river, 2.5 miles [4km] south of Black Head'. Later Webb (1962) noted that the plant grew in 'great profusion' at Fanore and had obviously extended its range since he first saw it there in 1947. Webb and Scannell (1983) list the plant as 'very abundant on the dunes at Fanore'. Reconnaissance of Fanore in 1990 showed that the plant is abundant over much of the mature dune system, from Murroogh in the north to the recreation area near the old schoolhouse in the south. Survey of pastures between Fanore and Black Head failed to relocate the plant in that area.

Until now, *C. epithymum* has not been recorded in any other mainland Burren station, but was found in 1890 on the Aran Islands (Nowers and Wells 1892), where it is frequent on dunes at Portmurvy and Killeany on Inishmore, and north of the landing-stage on Inishmaan (Webb and Scannell 1983). The Fanore and Aran sites for *Cuscuta* are located in the Burren Hills (District 2), the western section of the Burren as defined by Webb and Scannell (1983).

Ivimey-Cook and Proctor (1966) found that at Fanore *C. epithymum* occurred in mature dune grasslands, which they assigned to two classes, the Koelerio-Corynephoretea Klika in Klika et Novak 1941 and the Festuco-Brometea Br.-Bl. et Tx. 1943 cm. Tx. 1961.

There are no detailed descriptions of *C. epithymum* in heathland vegetation in Ireland, but materials in the herbarium at the National Botanic Gardens, Dublin, indicate that *Cuscuta* has been found on *Ulex gallii* in heathland.

In this paper, nomenclature for higher plants and mosses follows Tutin *et al.* 1964-80 and Smith 1978. Syntaxonomy follows the scheme for Irish vegetation presented in White and Doyle 1982.

A NEW LIMESTONE PAVEMENT HABITAT FOR *CUSCUTA* IN THE BURREN LOWLANDS

On 15 June 1990 *Cuscuta epithymum* was found growing among vegetation on limestone pavement south of Cooiloorta (Irish grid reference R3496) in the lowland area to the east of Mullagh More (Fig. 2), referred to as the Burren Lowlands (District 3) in Webb and Scannell 1983. The station lies about 30m above sea-level and some 17km from the sea at its nearest point, to the north at Kinvarra, Co. Galway. This constitutes a new record for the species in this part of the Burren.

At Cooiloorta, *C. epithymum* extends over an area of 50m x 50m. In places *Cuscuta* stems span



50cm of bare limestone between adjacent host plants. The area is grazed by cattle and a part has been used as a foddering area in winter.

The vegetation in which *Cuscuta* grows is typical of many pavement areas in the eastern part of the Burren (Table 1). This vegetation is classified as:

Asperulo-Seslerietum (Br.-Bl. et Tx. 1952) Shimwell 1971

Seslerio-Mesobromenion Oberd. 1957

Mesobromion (Br.-Bl. et Moor 1938 cm. Oberd. 1949) Oberd. 1957

Brometalia (Koch 1926 n.n.) Br.-Bl. 1936

Festuco-Brometea Br.-Bl. et Tx. 1943 cm. Tx. 1961

Vegetation of dry chalk grasslands in Europe is referred to the Festuco-Brometea. The diagnostic species for the Asperulo-Seslerietum, as listed by White and Doyle (1982), that are present in the vegetation at Cooiloorta include *Sesleria albicans*, *Geranium sanguineum*, *Carlina vulgaris*, *Asperula cynanchica*, *Hieracium pilosella*, *Blackstonia perfoliata*, *Sanguisorba minor*, *Filipendula vulgaris* and *Dryas octopetala*.

The vegetation is grass-dominated, low-growing (40cm) and confined to organic-rich soil about 10cm deep, among limestone pavements. In some places, exposed pavement is extensive and vegetation provides sparse cover. In quadrat 1, total vegetation cover is 40%, shrub cover 20%, herb

Fig. 1 — European distribution of *Cuscuta epithymum*. The Irish distribution is based on the vice-county distribution listed in Scannell and Synnott 1987. The British distribution is based on Perring and Walters 1976. The European mainland distribution is based on the works of Meusel *et al.* (1978) and Hultén and Fries (1986).

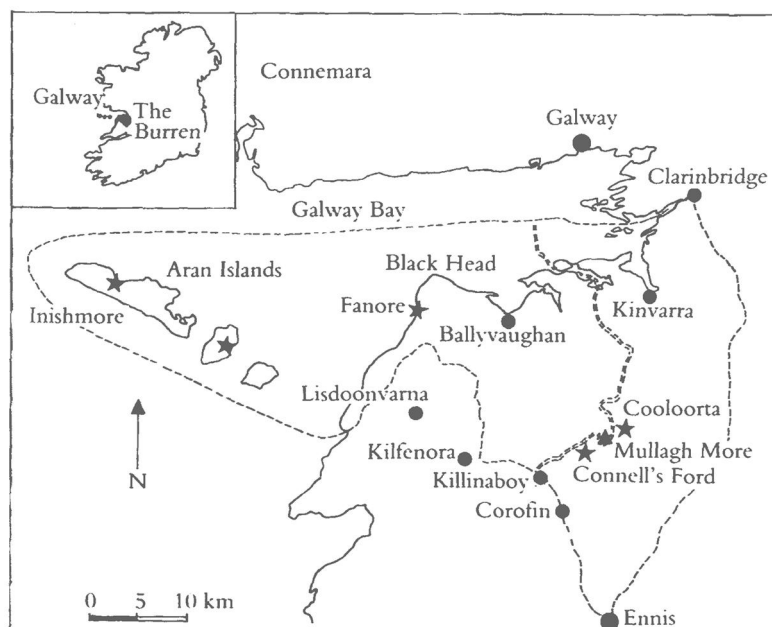


Fig. 2 — Location maps of the Burren region in Ireland, and the locations of sites at Inishmore (Aran Islands), Fanore, Coooororta and Connell's Ford (all three on the Burren mainland) that support *Cuscuta epithymum* (marked with star symbols). The Burren region includes the karstic limestone area of north-west Clare and the Aran Islands, which lie off the west coast of Ireland. The limits of the limestone region, as defined by Webb and Scannell (1983), are indicated by means of a single broken line. The Burren has been divided by Webb and Scannell into the Burren Hills (District 2) to the west, and the Burren Lowlands (District 3) to the east. The two districts are separated by the 61m (200ft) contour that skirts the hill of Mullagh More, which is indicated by a triangle. District 2/3 boundary is indicated by a doubled broken line running roughly in a north-south direction through the region.

cover 30%, and bryophyte cover 30%. In other places, vegetation cover is greater. In quadrat 2, total cover is 80%, with shrubs contributing 10%, herbs 60% and mosses 30%. The cover of *Cuscuta* is less than 5% in each of the quadrats.

The grassy sward is predominantly *Sesleria albicans*, with *Briza media*, *Festuca rubra*, *Carex flacca* and *Anthoxanthum odoratum* also present but with low cover. As is typical for this Burren grassland, there are several shrub species present that typically grow in a stunted or prostrate fashion: the more common of these include *Rosa pimpinellifolia*, *Dryas octopetala* and *Prunus spinosa*, while both *Calluna vulgaris* and *Thymus praecox* are present but have low cover. Herbaceous dicotyledons typical of this vegetation include *Geranium sanguineum*, *Teucrium scorodonia*, *Lotus corniculatus*, *Potentilla erecta*, *Minuartia verna*, *Asperula cynanchica* and *Hieracium pilosella*. Of the several mosses present *Breutelia chrysocoma* is predominant.

In September 1990, *Cuscuta* was found in flower on *Calluna vulgaris*, *Dryas octopetala*, *Thymus praecox*, *Rosa pimpinellifolia*, *Prunus spinosa*, *Achillea millefolium*, *Campanula rotundifolia*, *Geranium sanguineum*, *Lotus corniculatus*, *Potentilla erecta*, *Succisa pratensis*, *Teucrium scorodonia* and *Trifolium pratense* (specimens are lodged in the herbarium of the National Botanic Gardens, Dublin). In June 1991, the plant was again found in vigorous condition, extending over roughly the same area as the previous year, and in September 1991 was again found producing abundant flowers.

Subsequently, *Cuscuta* was found in another Burren Lowlands site in November 1991 by Dr Noel Kirby. The plant occurred in grassland

Table 1 — Relevés of limestone pavement vegetation containing *Cuscuta epithymum* found at Coooororta in the Burren Lowlands. Cover/abundance values according to the Braun-Blanquet scale are used (cf. Mueller-Dombois and Ellenberg 1974). The quadrat size is 10m x 10m. Total vegetation cover is 40% in relevé 1 and 80% in relevé 2.

Relevé number	1	2
Asperulo-Seslerietum character species		
<i>Dryas octopetala</i>	2	1
<i>Geranium sanguineum</i>	1	1
Seslerio-Mesobromenion character species		
<i>Sesleria albicans</i>	2	3
Festuco-Brometea character and differential species		
<i>Carlina vulgaris</i>	+	+
<i>Asperula cynanchica</i>	+	+
<i>Hieracium pilosella</i>	+	+
<i>Blackstonia perfoliata</i>	+	
<i>Sanguisorba minor</i>	+	
<i>Filipendula vulgaris</i>	+	
Companion species		
<i>Cuscuta epithymum</i>	1	1
<i>Rosa pimpinellifolia</i>	2	1
<i>Prunus spinosa</i>	2	1
<i>Thymus praecox</i>	1	1
<i>Calluna vulgaris</i>	+	+
<i>Teucrium scorodonia</i>	1	1
<i>Lotus corniculatus</i>	1	1
<i>Potentilla erecta</i>	+	+
<i>Minuartia verna</i>	+	+
<i>Succisa pratensis</i>	+	1
<i>Euphrasia</i> sp.	+	+
<i>Briza media</i>	1	1
<i>Festuca rubra</i>	+	1
<i>Carex flacca</i>	1	1
<i>Pteridium aquilinum</i>	+	1
<i>Breutelia chrysocoma</i>	2	1
<i>Tortella tortuosa</i>	+	+
<i>Dicranum scoparium</i>	+	+

Species confined to a single quadrat: **relevé 1** — *Centaurea nigra* +, *Crataegus monogyna* 1, *Daucus carota* +, *Myelis muralis* +, *Plantago maritima* +, *Polygala vulgaris* +, *Senecio jacobaea* +, *Solidago virgaurea* +, *Taraxacum officinale* +, *Asplenium ruta-muraria* +, *Crenidium molluscum* 1, *Homalothecium sericeum* +, *Neckera crispa* 1, *Pleurozium schreberi* +; **relevé 2** — *Antennaria dioica* +, *Anthoxanthum odoratum* +, *Trifolium pratense* +, *Homalothecium lutescens* 1, *Hylocomium splendens* +.

vegetation on a slope of an old excavation in glacial drift to the west of the roadway between Killinaboy and Mullagh More near the bridge at Connell's Ford (R2993), about 5km south-west of the Cooloorta site and at about 30m above sea-level. At that time *Cuscuta* was still in flower and grew on *Thymus praecox* and *Lotus corniculatus*.

COMPARISON OF THE LIMESTONE PAVEMENT AND MATURE DUNE HABITATS OF *CUSCUTA* IN THE BURREN REGION

The limestone pavement habitat and vegetation described from Cooloorta are markedly different to those at Fanore dunes and other Irish dune systems where *Cuscuta* has been recorded. Vegetation descriptions from sand-dune habitats at Fanore, Co. Clare (M1308), and Mullaghmore, Co. Sligo (G7157), made by the author in 1991, together with a summary of the descriptions from Fanore listed in Ivimey-Cook and Proctor 1966, are presented in Table 2.

The vegetation in which *Cuscuta* occurs in these areas is typical of stable landward dunes in the west of Ireland, and is classified as:

- Camptothecio-Asperuletum Br.-Bl. et Tx. 1952
- Eu-Mesobromenion Oberd. 1957
- Mesobromion (Br.-Bl. et Moor 1938 em. Oberd. 1949) Oberd. 1957
- Brometalia (Koch 1926 n.n.) Br.-Bl. 1936
- Festuco-Brometea Br.-Bl. et Tx. 1943 em. Tx. 1961

The character species of the Camptothecio-Asperuletum is *Asperula cynanchica*. Character and differential species of the alliance, order and class include *Koeleria macrantha*, *Hieracium pilosella*, *Ranunculus bulbosus*, *Blackstonia perfoliata*, *Gentianella amarella*, *Arenaria serpyllifolia*, *Carlina vulgaris*, *Homalothecium (Camptothecium) lutescens* and *Pleurochaete squarrosa*. The assignment by Ivimey-Cook and Proctor (1966) of several of their relevés to the Koelerio-Corynephoretea does not appear to be justified, as all have the diagnostic species of the Festuco-Brometea.

On the majority of the stable sand-dunes examined, the vegetation cover is complete and grass-dominated, with *Festuca rubra* forming the sward in most places. Scattered tussocks of *Ammophila arenaria* are a feature in some areas. Other notable higher plants include *Hypochoeris radicata*, *Trifolium pratense*, *Galium verum*, *Plantago lanceolata*, *Lotus corniculatus* and *Thymus praecox*. The prominent moss is *Tortula ruraliformis*.

At Fanore, *C. epithymum* forms extensive mats, with cover of up to 50% in places, so that the plant is visible from a distance. It is found on level ground

Table 2 — Sand-dune vegetation in which *Cuscuta epithymum* is found at Fanore, Co. Clare (columns 1–4 and column 6), and at Mullaghmore, Co. Sligo (column 5). Cover/abundance values according to the Braun-Blanquet scale are used for relevés 1–5. Roman numerals in column 6 are presence class values based on nine relevés taken from Ivimey-Cook and Proctor 1966: V = presence in 81–100% of the relevés, IV = 61–80%, III = 41–60%, II = 21–40% and I = 1–20%; the associated superscripts indicate the range of Braun-Blanquet values for each species in the relevé set. Quadrat size for relevés 1–5 was 5m x 5m.

	Relevés					
	1	2	3	4	5	6
Slope	10°	25°	0°	0°	5°	0–30°
Cover (%)	80	100	60	100	100	—
Camptothecio-Asperuletum character species						
<i>Asperula cynanchica</i>	+	1	.	1	.	V ⁺²
Festuco-Brometea character and differential species						
<i>Ranunculus bulbosus</i>	1	+	1	+	.	I ¹
<i>Homalothecium lutescens</i>	2	.	+	1	.	V ⁺³
<i>Koeleria macrantha</i>	.	+	.	+	+	II ¹⁻²
<i>Hieracium pilosella</i>	.	.	2	1	.	III ⁺¹
<i>Blackstonia perfoliata</i>	.	.	+	+	.	III ⁺¹
<i>Gentianella amarella</i>	.	.	.	1	.	I ⁺
<i>Pleurochaete squarrosa</i>	.	.	.	.	.	III ¹⁻²
<i>Arenaria serpyllifolia</i>	.	.	.	.	.	II ⁺¹
<i>Carlina vulgaris</i>	.	.	.	.	.	I ⁺
Companion species						
<i>Cuscuta epithymum</i>	2	2	1	2	1	V ⁺³
<i>Festuca rubra</i>	3	4	2	5	3	V ¹⁻⁴
<i>Ammophila arenaria</i>	3	3	2	.	1	IV ⁺¹
<i>Hypochoeris radicata</i>	1	1	1	1	.	IV ⁺¹
<i>Trifolium pratense</i>	2	1	.	1	2	
<i>Galium verum</i>	2	2	.	1	2	IV ¹⁻²
<i>Plantago lanceolata</i>	1	1	.	1	+	III ⁺¹
<i>Lotus corniculatus</i>	1	2	.	2	2	V ⁺²
<i>Tortula ruraliformis</i>	2	.	2	.	1	III ¹⁻²
<i>Thymus praecox</i>	1	.	1	2	2	V ³⁻⁴
<i>Agrostis stolonifera</i>	+	+	.	+	.	V ⁺²
<i>Anagallis arvensis</i>	+	.	1	.	.	IV ⁺¹
<i>Viola tricolor</i>	1	.	.	1	+	.
<i>Carex arenaria</i>	1	.	.	1	+	I ⁺
<i>Taraxacum officinale</i>	1	+	.	.	.	IV ⁺¹
<i>Rhytidadelphus squarrosus</i>	+	.	.	1	1	II ¹
<i>Pseudoscleropodium purum</i>	+	.	.	1	.	II ¹
<i>Holcus lanatus</i>	.	+	.	+	.	.
<i>Cynosurus cristatus</i>	.	+	.	1	.	.

Table 2 continued

<i>Medicago lupulina</i>	.	1	.	1	.	V ¹⁻²
<i>Euphrasia</i> sp.	.	+	.	1	+	.
<i>Ditrichum flexicaule</i>	.	2	.	.	.	IV ⁺³
<i>Bellis perennis</i>	.	+	+	+	+	V ¹⁻²
<i>Poa pratensis</i>	.	.	.	1	.	I ¹
<i>Cerastium fontanum</i>	.	.	.	+	.	IV ⁺¹
<i>Carex flacca</i>	.	.	.	+	.	II ¹⁻²
<i>Linum catharticum</i>	.	.	.	+	1	IV ¹
<i>Luzula campestris</i>	.	.	.	1	+	IV ⁺¹
<i>Leontodon taraxacoides</i>	.	.	.	.	2	IV ¹⁻²
<i>Prunella vulgaris</i>	.	.	.	.	+	II ⁺¹
<i>Centaureum erythraea</i>	.	.	.	.	+	III ⁺¹
<i>Peltigera canina</i>	.	.	.	.	+	IV ¹

Additional species: **relevé 1** — *Lapsana communis* +; **relevé 2** — *Briza media* 1, *Ctenidium molluscum* 1; **relevé 4** — *Poa annua* +; **relevé 5** — *Carex panicea* 1, *Climacium dendroides* 1, *Hylocomium splendens* 2, *Pleurozium schreberi* 1, *Sagina nodosa* +, *Senecio jacobaea* +, *Thuidium tamariscinum* 2, *Veronica chamaedrys* +; **column 6** — *Campanula rotundifolia* II¹, *Desmezeria rigida* II⁺¹, *Cerastium diffusum* II⁺¹, *Euphrasia salisburgensis* II¹, *Festuca ovina* II¹⁻³, *Plantago coronopus* II¹, *Polygala vulgaris* II⁺, *Trifolium repens* IV¹⁻², *Viola riviniana* IV⁺¹, *Entodon concinnus* III¹⁻², *Hypnum cupressiforme* var. *lacunosum* IV⁺², *Lophocolea bidentata* II⁺¹ (bryophytes confined to just one or two relevés in Ivimey-Cook and Proctor's data have been omitted for brevity).

Table 3 — Host species for *Cuscuta epithymum* at Cooloorta and Fanore in County Clare and on plant specimens at the herbarium, National Botanic Gardens, Dublin.

Major host species, found at Cooloorta, at Fanore and on herbarium materials

Achillea millefolium, *Lotus corniculatus*, *Thymus praecox*.

Hosts common to Cooloorta and Fanore

Asperula cynanchica, *Trifolium pratense*, *Viola* species.

Hosts at one field site (C = Cooloorta; F = Fanore) and in herbarium material

Festuca rubra (C), *Potentilla erecta* (C), *Galium verum* (F).

Hosts confined to Cooloorta

Antennaria dioica, *Asplenium ruta-muraria*, *Blackstonia perfoliata*, *Calluna vulgaris*, *Dryas octopetala*, *Campanula rotundifolia*, *Geranium sanguineum*, *Minuartia verna*, *Prunus spinosa*, *Rosa pimpinellifolia*, *Succisa pratensis*, *Teucrium scorodonia*.

Hosts confined to Fanore

Bellis perennis, *Briza media*, *Cerastium fontanum*, *Euphrasia salisburgensis*, *Hieracium pilosella*, *Hypochoeris radicata*, *Koeleria macrantha*, *Luzula campestris*, *Plantago lanceolata*, *Polygala vulgaris*, *Ranunculus bulbosus*, *Rhinanthus minor*, *Rhynchospora squarrosus*, *Taraxacum officinale*.

Hosts on herbarium material

Anthyllis vulneraria, *Centaurea nigra*, *Daucus carota*, *Erica mackaiana* (planted), *Erica tetralix* (planted), *Eryngium maritimum*, *Lathyrus pratensis*, *Leucanthemum vulgare*, *Medicago lupulina*, *Ononis repens*, *Senecio jacobaea*, *Trifolium* species, *Ulex gallii*.

and on the flanks of dunes on slopes of up to 25°. Evidence of heavy grazing by rabbits and domestic animals is apparent in most places. The northern part of Fanore at Murroogh and the stable dunes at Mullaghmore in County Sligo are major rabbit-warrens.

While there are marked differences between the sand-dune vegetation at Fanore and the limestone pavement vegetation described from Cooloorta, there are species common to the two habitats. These include *Asperula cynanchica*, *Blackstonia perfoliata*, *Carlina vulgaris*, *Euphrasia* species, *Hieracium pilosella*, *Lotus corniculatus*, *Polygala vulgaris*, *Senecio jacobaea*, *Taraxacum officinale*, *Thymus praecox*, *Trifolium pratense*, *Briza media*, *Carex flacca*, *Festuca rubra*, *Ctenidium molluscum*, *Homalothecium lutescens*, *Hylocomium splendens* and *Pleurozium schreberi*.

HOST PLANTS FOR CUSCUTA IN ITS BURREN HABITATS

Several authors have identified host plants for *Cuscuta* in Ireland. More (1892) listed *Thymus praecox*, *Lotus corniculatus*, *Trifolium repens* and *Galium verum* as hosts of *Cuscuta* on dunes at Tramore, Co. Waterford. Webb (1962) listed *Thymus praecox*, *Lotus corniculatus* and *Euphrasia* species as hosts at Fanore dunes, while Webb and Scannell (1983) identified *Thymus praecox* and *Lotus corniculatus* as the major hosts at Fanore, and *Galium verum* and *Asperula cynanchica* as minor hosts there. While these statements appear to restrict the number of hosts, the parasite is known to have a wide variety of host species in Britain (Stace 1991) and continental Europe (cf. Frolisek 1981).

In examining the vegetation containing *Cuscuta* at Fanore and Cooloorta in the Burren, it became apparent that the parasite was also distributed on a wide variety of species, so a systematic survey of *Cuscuta* hosts was undertaken at these Clare sites (Table 3). Hosts identified in the field were those to which *Cuscuta* was attached by suckers that left distinct holes in the plant on removal. A list of host species in preserved plant materials at the herbarium of the National Botanic Gardens, Dublin, is also included.

A total of 48 host species for *Cuscuta* were identified. The major hosts are *Achillea millefolium*, *Lotus corniculatus* and *Thymus praecox*, species that were located at both of the field sites and found on several herbarium specimens. Three hosts, *Asperula cynanchica*, *Trifolium pratense* and *Viola* species, were found at the two Burren stations investigated, while *Festuca rubra*, *Galium verum* and *Potentilla erecta* were hosts at one or other of the Burren sites and found on herbarium material. Of the other 26 host species located in the field, 12 were confined to the limestone pavement habitat at Cooloorta and 14 to

the sand-dunes at Fanore. An additional 13 hosts were identified in herbarium material at the National Botanic Gardens, Dublin.

The preferred hosts for *Cuscuta epithymum* throughout its range in Europe (Tutin *et al.* 1972) include *Trifolium* species, *Calluna vulgaris* and *Ulex europaeus*. Among the Irish herbarium specimens *Ulex gallii* rather than *U. europaeus* is a common host.

DISCUSSION

There are two possible explanations as to why *Cuscuta epithymum* was not found in the inland parts of the Burren prior to 1990. Botanists up to that time may have overlooked the plant in that area. Cooiloorta is an interesting botanical site where *Ophrys insectifera*, *O. apifera*, *Plathantha bifoliata* and *Neotinea maculata* coexist, where *Potentilla fruticosa* and *Schoenus fens* are easily accessible, and where *Botrychium lunaria* has been located on several occasions (Doyle 1987). Despite frequent visits, including the early summers of 1988 and 1989, the species was not encountered at Cooiloorta. It must be stressed that unless the plant occurs in massive amounts, as is the case with the colonies on the dunes at Fanore, the species can be difficult to detect owing to its low-growing habit. This is especially the case in the early part of the growing season when the thread-like stems have just commenced their development and the previous year's above-ground material has disintegrated. The plant is most readily observed during its flowering period from July to September, when it climbs stems of hosts such as *Achillea millefolium* or *Teucrium scorodonia*, so that the diminutive pink flowers are raised above ground level and become relatively obvious. Although the Burren is frequently visited by botanists, the majority arrive in the early summer period (mid to late May) when the Burren specialities such as *Dryas octopetala*, *Gentiana verna*, *Neotinea maculata* and *Ajuga pyramidalis* are in flower. As a result, late-flowering species in the region may be under-recorded.

A second explanation is that *Cuscuta* has recently arrived at Cooiloorta and Connell's Ford, through independent, chance introductions of seeds. Kuijt (1969) considers that dispersal in *Cuscuta* is rather haphazard, and while seeds can pass through the intestinal tract of sheep unharmed, animals as dispersal agents are generally unimportant. Discussion with local farmers confirmed that there is no movement of cattle between the inland sites and Fanore, and that cattle fodder is produced in the immediate vicinity of the inland sites and is not transported from anywhere near the previously known site at Fanore.

At Cooiloorta, *Cuscuta* is well established as it has flowered extensively and has survived at the site, either as seed or as vegetative material on some host

plants, a perennating mechanism described for *C. epithymum* in central Europe (Stojanovich 1959), over at least one winter period.

It will be interesting to monitor the fate of *Cuscuta epithymum* in its habitats in the Burren Lowlands. If the plant is newly introduced to the Cooiloorta and Connell's Ford sites it is tempting to speculate that it will extend its distributional area there. It should remain a permanent resident of the low-growing grazed grassland, which is analogous to the sand-dune vegetation at Fanore in terms of openness of structure and, to some extent, in species composition. There are host species common to the Fanore and Cooiloorta sites, including *Lotus corniculatus*, *Thymus praecox*, *Asperula cynanchica*, *Achillea millefolium*, *Trifolium pratense* and *Viola* species. Hosts of *Cuscuta*, known from elsewhere in Ireland, such as *Festuca rubra* and *Potentilla erecta* also occur there.

While it is evident from the information presented here that *Cuscuta* is catholic in its selection of host plants at the Clare sites, its rarity in Ireland suggests that establishment is a critical factor determining its distribution. Establishment depends on seed germination and infection of a suitable host species, processes that in turn depend on the suitability of the habitat and environmental conditions and the availability of host species. As vegetation communities are sensitive monitors of environmental and habitat factors, establishment of *Cuscuta* may be restricted to particular vegetation types. Once established on a suitable primary host in vegetation containing a number of potential host species, *Cuscuta* may then readily spread and become a permanent resident there.

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