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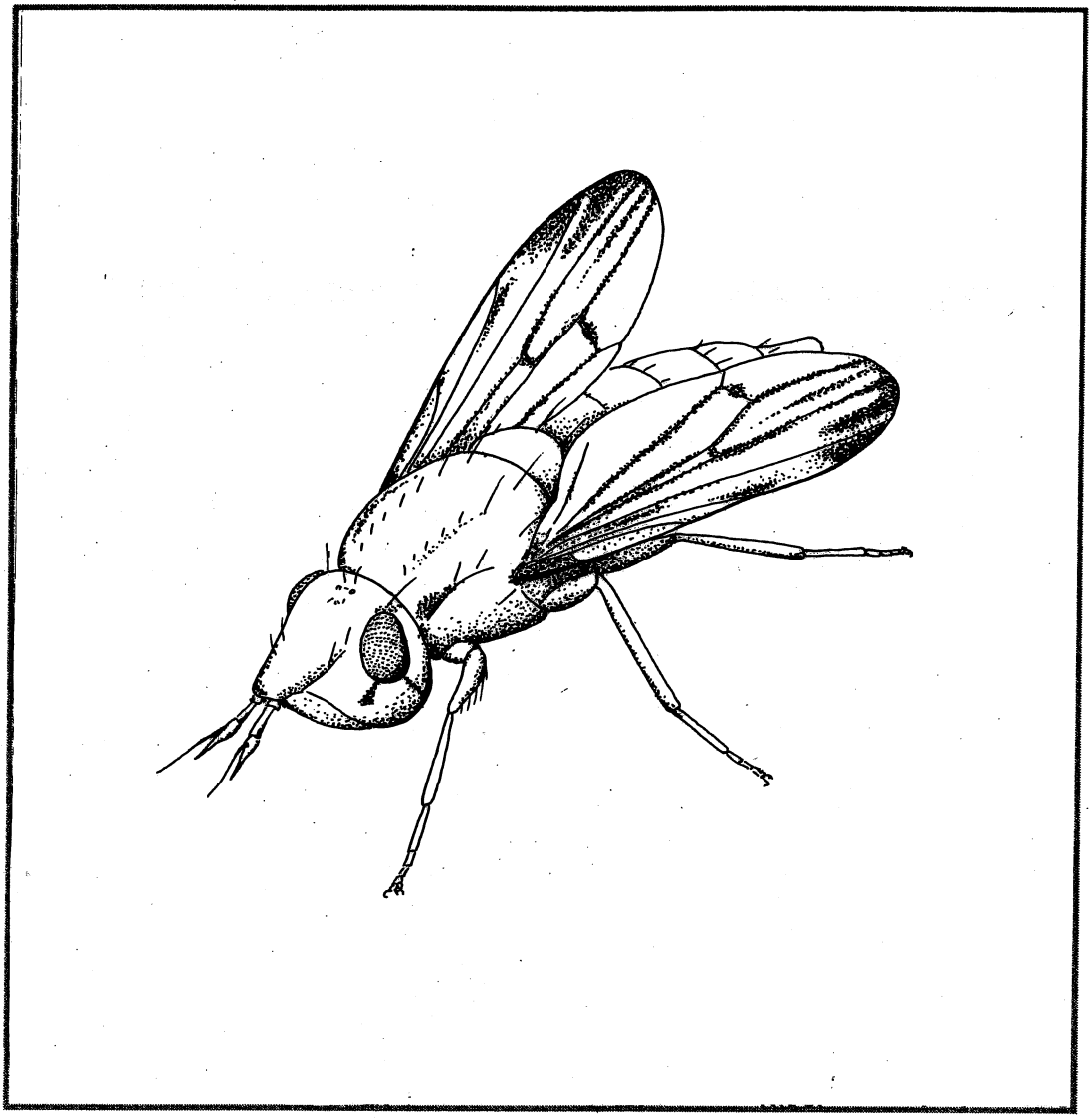

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The status, distribution and biology of *Dorycera graminum* (Fabricius) (Diptera, Ulidiidae)

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Contents

1. Introduction

Dorycera graminum is a large picture-winged fly up to 1 cm long, with slightly marked wings and is distinctive among other British flies. It has been accorded Red Data Book Category 3 status (Rare) (Falk 1991) and was listed as a priority species in the Biodiversity Action Plan as it appears to have decreased in numbers in recent years and may be a suitable species to promote conservation of invertebrates in some types of grasslands (Stubbs 1997; UK Biodiversity Group 1999). The plan includes actions to undertake survey to determine the fly's status and to conduct targeted autecological research to elucidate the causes of decline and inform habitat management. This work was commissioned to take forward parts of these actions by establishing the current distribution of *Dorycera* using existing records and undertaking a survey a the historical sites where these are identifiable and retain suitable habitat. As the preferred habitat is unclear and the genus has not been reared, the survey included recording environmental variables that help to define the habitat requirements or habitats occupied. The information will form the basis for more detailed autecological studies which will be necessary before clear proposals for the conservation can be formulated.

2. Results

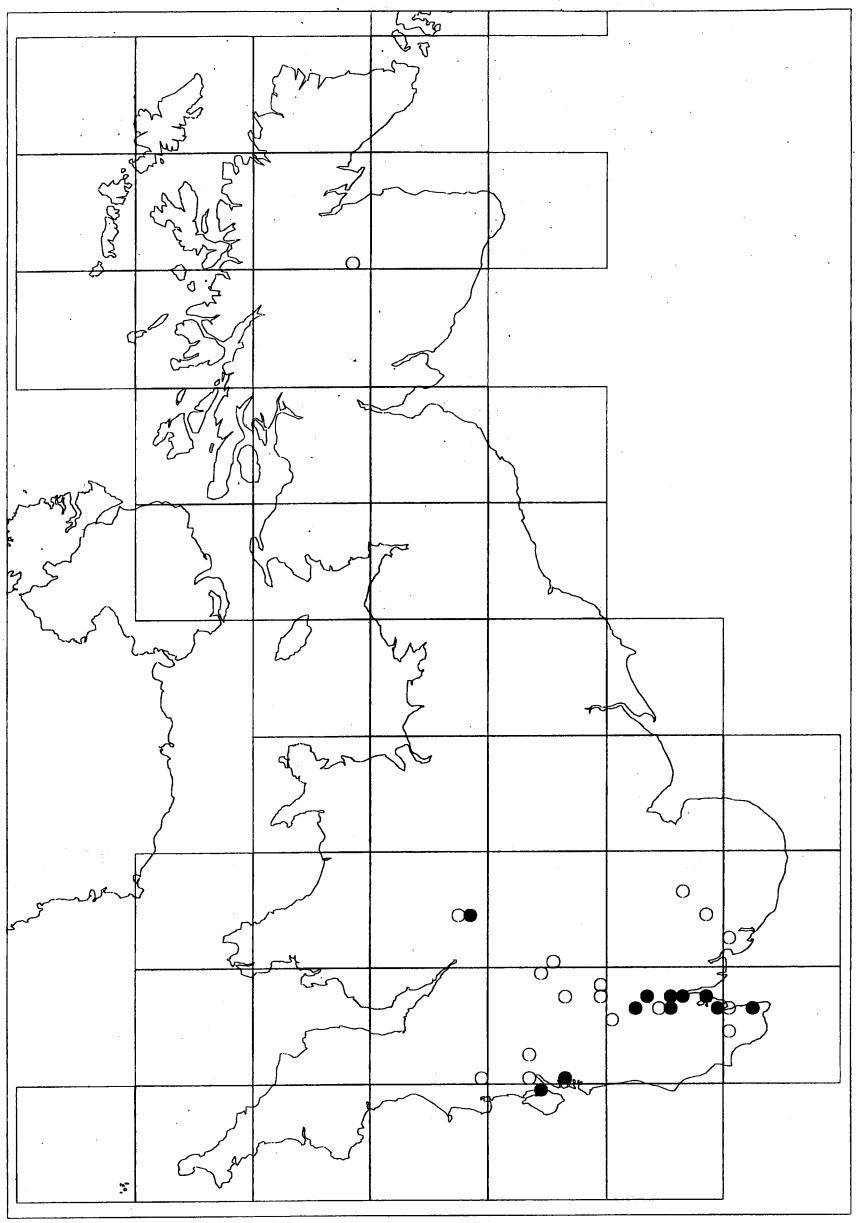
2.1 Distribution

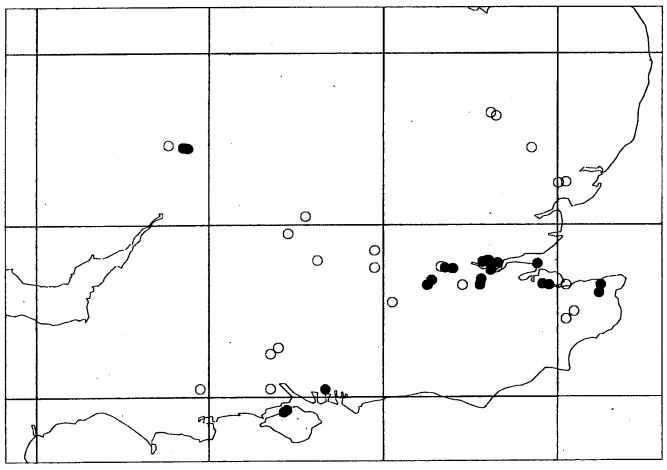
Soós (1984) gives the distribution of the species as "Europe, except for North Europe; USSR: CET, SET; Asia: Turkey." In Britain it is recorded from the south-east of England with records as far west as Worcestershire and as far north as Huntingdonshire, with old records from the north of Scotland (Map 1).

2.2 Life history

There are no confirmed recent rearing records of this species, although Smith (1989) refers to old records by Robineau-Desvoidy and Macquart of the fly ovipositing in the ovaries of black bryony, *Tamus communis* L. Robineau-Desvoidy (1830) wrote "J'ai trouvé cet insecte en abondance sur les fleurs du *Thamnus vulgaris*, don't sa femelle perforait les ovaires. Comme je l'ai souvent rencontré dans des localités où le *Thamnus* ne crôit point, il doit vivre sur d'autres végétaux. Le mâle est plus petit que la femelle: en général, la taille offre de nombreuses variétés, ainsi que la coloration des ailes." [I have found this insect in abundance on the flowers of *Thamnus vulgaris* (=*Tamus communis*) of which the female perforates the ovaries. As I have often found it in localities where *Thamnus* does not grow any more it must live on other plants. The male is smaller than the female, in general the size varies, as does the colour of the wings]. *Tamus communis* was not seen at any of the sites investigated.

Within the family Ulidiidae there are records of saprophagous and phytophagous species. Ferrar (1987) provides the most comprehensive review of life histories of Ulidiidae. There are two subfamilies of Ulidiidae: Ulidiinae and Otitinae. They are currently considered as one family (Chandler, 1998) but at various times both have been elevated to family rank. *D. graminum* is in the Otitinae. Thus in attempting to extrapolate from known host records it is important to note the subfamily concerned. It is worth summarising the possible life histories of this fly.





Dorycera graminum distribution by 10km square (upper) and individuals records. Dates: solid circles 1970 onwards, open circles, pre-1970.

2.2.1 Saprophagy

Ferrar (1987) included 17 out of 35 species of known biology in categories that were basically saprophagous. These were in both subfamilies and were found in a range of media including rotting vegetable matter, rotting fruit, silage, garden compost, refuse bins and pond muck. If *D. graminum* is saprophagous it is difficult to explain its recent contraction in range and numbers, unless there is some other factor such as land management or water regime which has changed. Nevertheless, some form of saprophagy is a likely biology for *D. graminum* since it is probably the primitive condition in the family. The association with various species of large umbellifers is a possible lead.

2.2.2 Dung

Ferrar (1987) included five species in this category and there was no large animal dung at the sites where the author has seen large numbers of the species; it is considered an unlikely breeding medium.

2.2.3 Under bark

Ferrar (1987) included 12 species in this category, but most of the habitats which support *D. graminum* have a minimal amount of dead bark. This is also a well studied microhabitat and it is unlikely that such a large fly would have been missed if it bred regularly under bark.

2.2.4 Phytophagy

Ferrar (1987) included 11 species in this category, in both subfamilies. His review indicated that "Species attacking living plants are specific to a narrow host range." *Tetanops myopaeformis* (Röder) attacks the roots of sugar beet in North America. *Chaetopsis apicalis* attacks stems of cord grass, *Spartina cynosuroides* but related species of *Chaetopsis* are secondary invaders of damaged plant tissue. *Tritoxa flexa* (Wiedemann) is a minor pest of onions in North America. There is evidently a gradation from saprophagous to secondary invader to primary invader. *Eumetopiella rufipes* (Macquart) lives in the ensheathed inflorescences of barnyard grass *Echinochloa crusgalli* (L.) Beauvois in North America. *E. rufipes* is in the subfamily Ulidiinae but has an elongate flattened head very similar to that of *D. graminum.* Such a head shape and an elongated body is a feature of several flies living in grass, rush or sedge stems, which is a confined environment. Examples are *Platycephala* and *Pachylophus* (Chloropidae) and *Loxocera* (Psilidae). This leads to the possibility that *D. graminum* may live in *Agropyron* inflorescences, present at many of the sites surveyed. Some of the Diptera which live in generative bodies of grasses exit the grass prior to pupariation, so the puparia may be found in the soil or debris.

2.3 Adult biology

2.3.1 Association with plants

Clemons (1994) recorded this species associated with hogweed (*Heracleum sphondylium* L.) and alexanders (*Smyrnium olusatrum* L.). Alexander (1998) swept the species from hemlock water-dropwort (*Oenanthe crocata* L.). At Chafford Hundred it was swept from hawthorn in flower. Clemons (1999) found specimens on elm (*Ulmus procera* Salisb.), spindle (*Euonymus*

europaeus L.) and honeysuckle (*Lonicera* sp.). He considered it possible that the larva of *D. graminum* may feed on mites or aphids on elm or spindle, though there is no record of a similar life history in the Ulidiidae. There is an earlier record of *D. graminum* on elm, however; the plate of this fly in Pearce (1928) is accompanied by a label which includes "Not generally common but local; beaten from Wych Elm". No locality is given and the specimens shown in the plate are in the Hope Entomological Collections, also without location data. Two further specimens in the Hope Entomological Collections presented by E.K. Pearce are from Colchester and Burnham.

2.3.2 Flower feeding

At the Grain site reported upon below the species was found feeding on heads of hemlock (*Conium maculatum* L.).

2.3.3 Laboratory studies

Specimens from the Grain site listed below were brought back to the laboratory to observe their behaviour. The flies fed frequently on sugar and water, so they presumably need some form of adult food in the field. This would explain the association with umbellifers since such plants are a good general source of nectar for insects. The last adult fly died after 4 weeks in the laboratory.

The wing-waving behaviour so characteristic of Ulidiidae was performed by both sexes in cages and may be concerned with territory. On at least one plant of hemlock in the field at Grain the flies were distributed one to each flowerhead and were displaying.

Female flies spent some time sampling various substrates with their ovipositors. The paper plug of the cage (a fruit juice bottle) was investigated. Okely (1974) used baits of grass cuttings to attract saprophagous Sphaeroceridae for oviposition. A similar approach was tried for D. graminum; a container of boiled grass was sampled with the proboscis but no sustained attempt to use it for oviposition was noted. On a few occasions the females put their ovipositors into the grass but did not maintain this behaviour. Some grass heads were introduced and one female investigated a head of *Dactylis glomerata* L. for over a minute, but no egg-laying was seen.

2.3.4 Phenology

The dates of capture covered May 15th to July and the number of records is in Table 1. The figures in the body of the table are numbers of records.

Table 1. Dates of occurrence of *Dorycera graminum*

10.v.-20.v.	21.v.-31.v.	1.vi.- 10.vi.	11.vi.- 20. vi.	21.vi.- 30.vi.	vii.
6	2	7	9	2	1

This shows that most records are in late May and early June; the July record is the single Scottish site and may be atypical.

3. Discussion

The field results in 1999 were poor due to adverse weather conditions during much of May and early June. Five records were made by the writer or other dipterists so the species is clearly not in immediate danger of extinction. A noteworthy feature of this species appears to be the fluctuations in population levels from one year to another. Most records appear to be of single specimens, yet it can occur in large numbers one year and be absent the next (as at Chafford Hundred). There is certainly a problem with monitoring populations of this species since there are few records of the species in successive years at the same site. Most of the records were made by sweeping or field collecting of adults and until the life history is discovered the collection of adults remains the only method of monitoring populations.

The 1999 survey was mainly in the south-east where most recent records have been made. This area has low rainfall and high insolation and there are some further sites that should be surveyed in 2000 in Kent and Essex. The central south coast was not covered in 1999 and in 2000 the sites in Dorset and the Isle of Wight should be covered.

The data collected during this survey did not resolve the question of the preferred habitat of *D. graminum*. The older sites have not been considered since there is generally little information about habitat type, land usage and management. The sites surveyed ranged from xeric grassland to wetland, from open habitat to shaded, from light sandy soils to clay and from calcareous to slightly acid. Grassland of some kind is a common factor, but the types of grassland varied greatly. Almost the only other common factor in the recent sites was some degree of disturbance, either a history of use for sand, gravel or chalk extraction or major clearance of vegetation.

The life history work has not been completed since it was considered that the best time to revisit Grain to search for puparia would be February, when many Diptera late larvae or puparia are most easily found.

4. Site reports

The following reports are based on visits during this survey or in recent years. The sections on managements considerations are based on the recommendations for *D. graminum* in an unpublished review of the scarce and threatened flies of Great Britain, a continuation of Falk (1991), (Acalyptrates, Falk & Ismay) which states: "Maintain a rich and varied vegetation in meadows, retaining any marshy areas and discouraging excessive scrub invasion".

Site: Croome Park, Worcestershire, SO 879 445

Date visited: 4.vi.1999. Previous record: 12.vi.1995.

Weather: Cool and windy, some sunshine later on but insects not highly active.

Ownership: National Trust.

Croome Park is a landscaped park with varied topography. *D. graminum* was reported from the ornamental garden by Alexander (1998). This area is a slow, artificial river with the

margins gardened and planted with a variety of native and exotic coniferous and deciduous trees. It had been badly overgrown but there is evidence of drastic recent management in cutting back young trees and other vegetation, leaving grasses and mixed herbage under light shade. The ground is relatively wet. The plants noted included nettles and burdock, while hogweed and other umbellifers were flowering at the time of the visit. The hedges included some hawthorn. *D. graminum* was not seen.

This site does not appear similar to others for *D. graminum.* An adjacent area of short grassland was also swept without success and most of the surrounding area was planted to crops, including rape.

Management considerations: The current management involves considerable scrub and tree clearance, which is probably beneficial to this species.

Site: Morden Hall Park, Watermeads, Surrey, TQ 274 677

Date visited: 9.vi.1999. Previous record: 19.vi.1996.

Weather: Cool, some sunshine.

Ownership: National Trust.

The site is an old poplar plantation along the River Wandle, being cleared to restore marshy grassland. Alexander (1998) recorded the species from the *Epilobium hirsutum* sub-community of *Phragmites australis - Urtica dioica* fen, swept from hemlock water-dropwort (*Oenanthe crocata*). There were flowering hemlock water-dropwort plants along the river and many hogweeds in flower, but no *D. graminum* were found. This area has undergone great disturbance in recent years but is still much more heavily shaded than most of the sites in south-east England.

Management considerations: The current management involves considerable scrub and tree clearance, which is probably beneficial to this species.

Site: Gun Hill, West Tilbury, Essex, TQ 654 777

Date visited: 11.vi.1999. Previous record: v.1999.

Weather: Cool with light rain.

Ownership: Private.

An old sand and gravel pit with partly exposed banks. The substrate is sand and gravel. It occupies the top of a small hill and the site is slightly below (2-3m) the level of the top of the hill. It is not known when the quarry ceased production. A public footpath crosses the site. The floor of the site is horse pasture and appears to have been partially seeded with legumes. There are a few small hawthorns around the edges and some small patches of nettles, but the vegetation is generally very short and umbellifers were not present in numbers and flowers

were not abundant. It is grazed by rabbits as well as the horses. No *D. graminum* were found but the weather was poor.

Management considerations: Management would appear to be beneficial to the species since the grazing is encouraging botanical diversity and preventing scrub invasion.

Site: Grain, Isle of Grain, Kent TQ 883 772

Date visited: 14.vi.1999. Previous record 1994.

Weather: Warm and dry, sunny.

Ownership: Private.

The site is a partially worked sand and gravel quarry, with active working to the south of West Lane. There is a track running north of West Lane towards the coast (leading to the extraction works) and the block to the west of the track is the site indicated by the grid reference. *D. graminum* was present in very large numbers; one sweep of the net yielding 2-3 flies in some parts. The habitat is grassland dominated by *Agropyron* spp., with *Arrhenatherum elatius* (L.) P. Beauv. ex J. & C. Presl, *Holcus* sp., *Anisantha sterilis* (L.) Nevski and some *Juncus* sp. There were scattered hemlock plants in flower and a patch of alexanders not in flower to the east of the site. Sallow and other scrub is beginning to invade the site. Adult *D. graminum* were conspicuous on hemlock flower heads and were seen displaying and feeding. A patch of creeping thistle was in flower and one *D. graminum* was swept from it but no feeding was observed. They were also seen sitting on grasses. *D. graminum* was found from West Lane to the extraction works. The substrate was sand and gravel, dry at the time but clearly partially under water at some times of the year. This block was reported to have been extracted since 1960 and several metres of sand and gravel removed. The area to the east of the track had several pools and less open grassland, but a few *D. graminum* were found. The pools had marsh/edible frogs in large numbers.

Management considerations: This is the best site for *D. graminum* and consideration should be given to its future usage and management. *D. graminum* seems to thrive here in long herbage but the site would probably become scrub if wholly neglected. A light cutting/grazing regime in compartments every 2-3 years would probably be the best option.

Site: Church Marshes Country Park, Kent TQ 913654

Date visited: 14.vi.1999. Previous record: 1996.

Weather: Warm, dry, overcast.

Ownership: Local Council (Sittingbourne).

An area of mixed grassland and other ground species, with *Arrhenatherum elatius* dominating but some *Agropyron* present. Hogweed and hemlock were both abundant and in flower but no alexanders were seen. The site is being invaded by brambles, thistles and horseradish and some

hawthorn scrub. The substrate may have been clay originally but there was considerable evidence of tipping some years previously. No *D. graminum* were found.

Management considerations: Some regular clearance of longer vegetation and scrub would be beneficial to this site.

Site: Chafford Hundred, Essex TQ 57/TQ67

Date visited: 10-11. vi.1999. Previous records - 1995 - 1998

Weather: Mostly cool and overcast.

Ownership: Chafford Hundred Development Corporation.

Chafford Hundred is a housing development on a disused chalk and sand quarry. The substrate is chalk with a thin layer of sand on top, both removed to varying depths. From 1995 to the present the development has been monitored for Diptera and aculeate Hymenoptera and *D. graminum* was recorded from ten sites within Chafford Hundred. The number of records and of flies varied considerably during the period, for example *D. graminum* was found at five sites in 1997, in some numbers, but none in 1998. Five of the ten sites were re-surveyed during the present work:

Warren Gorge

The gorge is the remains of a deep chalk extraction, with pools and an area filled with calcareous spoil. This latter area has a rich flora with long grasses, hogweed and wild parsnip. There are two translocated plots from other parts of the development and the earlier surveys were confined to these areas. *D. graminum* was found here in 1997 but was not found on 10 June 1999; in a later survey on 18.vi.1999 two specimens were seen.

Lion Gorge

The area concerned is a strip between two deep excavations. There are open sandy areas with extensive bramble and scrub invasion, with heavy rabbit grazing. There are many umbellifers including hogweed and hawthorn in the hedges. The grasses vary from long to very short and one *D. graminum* was swept on 10 June 1999. Earlier records were for 1995.

Railway Embankment

A narrow strip of stony soil along the western edge of the development, bordering the railway line. *D. graminum* was found here on 19.v.1997 but was not recaptured in 1999. The railway runs through a deep cutting here and the Railtrack land is heavily grazed by rabbits and could well support *D. graminum*. It was not surveyed.

New Sandmartin

An artificial sand cliff was developed at this site, associated with a small piece of dry grassland. *D. graminum* was found in this grassland on 19.v.1997 but none were found on 11 June 1999.

Gibbs Wood

A small piece of probably ancient woodland with an open footpath along the south edge which is heavily rabbit grazed. There is a thin cover of grass and herbs. *D. graminum* was found here on 19.v.1997 but none were found on 11 June 1999.

Management considerations: Chafford Hundred as a whole is unusual among the sites considered in that *D. graminum* has been found in several parts of the site over several years - most of the other records are more restricted in numbers or time. This could be a function of the more frequent recording which has been conducted at Chafford Hundred. The recorded habitats are also variable in character, as with the whole British set of records. The fragmented nature of Chafford Hundred may be an advantage to the conservation of *D. graminum* since if one part becomes unsuitable another may remain or become favourable for the species. Some management to keep grassland and cliffs open has already been recommended and should favour *D. graminum.*

Site: Burnham Beeches NNR, Buckinghamshire SU 98

Date visited: 15.vi.1999. Previous record: 4.vi.1901.

Weather: Cool and overcast.

Ownership: Corporation of London

The record from Burnham Beeches was in 1901 by P. Harwood. The site has been the subject of an intensive study of Diptera since 1995 and it is unlikely that *D. graminum* would have been missed. It is probable that the site is no longer suitable for the species since there are no large areas of rough grassland. The southern part of the site is currently covered in thin woodland, mainly birch and Scots pine. There are pictorial records which show that this area was open grazed grassland about 1900 and this habitat would have been more suitable for *D. graminum.*

Management considerations: Areas of open heath on the southern part of Burnham Beeches have been cleared in recent years and may provide more suitable habitat, but it is not considered that management for *D. graminum* should be a high priority at Burnham Beeches. The habitat has been so unsuitable for so long that it seems unlikely that the species will have survived.

Site: University Parks, Oxford SP 50

Date visited: Various. Previous record: 1931.

Weather: Various.

Ownership: University of Oxford

The University Parks contain managed playing fields for rugby and cricket and other recreational areas. There is a variety of tree species and flower beds and some longer vegetation, particularly along the River Cherwell. In several years of casual collecting no *D. graminum* have been seen here. One teneral specimen was found on the lawn of the University Museum, very close to the Parks, in May 1997. The lawn is closely mown and improved, but some returfing had been carried out the previous winter and it seems most likely that a puparium was introduced from elsewhere. On the opposite side of the river from the Parks is an area of water meadows with rich vegetation. This land is part of the Cherwell Meadows SSSI and is more suitable than the Parks. Considerable collecting has been carried out here in recent years and no records of *D. graminum* have resulted.

Management considerations: None, since the Parks are now heavily managed for sports and the management of the meadows opposite is probably suitable for *D. graminum*. The meadows are maintained for high floral diversity by late summer mowing.

Acknowledgements

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Appendix 1. Distribution records of *Dorycera graminum* in Britain

Grid. Ref.	VC	Locality	Collector	Date
NH 80	96	Kincraig	P. Harwood	vii.1947
SO 7646	37	West Malvern	C.J. Wainwright	1901
SO 879445	37	Croome Park	K. Alexander	12.vi.1995
SP 50	23	Bayswater	A.H. Hamm	1914
SP 50	23	Bayswater	A.H. Hamm	5.vi.1915
SP 50	23	Oxford, Parks	L.W. Grensted	8.vi.1931
ST 90	9	Witchampton	P. Harwood	26.v.1949
SU 30	11	New Forest	P. Harwood	1929
SU 3928	11	Farley Downs	J.E. Collin	11.vi.1933
SU 49	22	Tubney	A.H. Hamm	31.v.1914
SU 6604	11	Hilsea Moats	I.R. Hudson	1986
SU 619793	23	Hartslock SSSI	J.H. Cole	1955
SU 97	22	Windsor Forest	H. Donisthorpe	28.vi.1935
SU 98	24	Burnham Beeches	E.K. Pearce	
SU 98	24	Burnham Beeches	P. Harwood	4.vi.1901
SZ 4291	10	Newtown Marshes	I.F.G. McLean	1981
SZ 442926	10	Gurnard Ledge to Sal	I.F.G. McLean	1981
TL 6165	26	Exning	G.H. Verrall	1.vi.1885
TL 6463	26	Newmarket	J.E. Collin	9.vi.1941
TL 84	26	Sudbury	P. Harwood	1926
TM 02	19	Colchester	E.K. Pearce	pre 1960
TM 0024	19	Colchester	P. Harwood	1925
TM 0024	19	Colchester	P. Harwood	1969
TR 04	15	Boughton Aluph	H.W. Miles	30.v.1949
TR 0949	15	Wye & Crundale Downs	C.G. Lamb	1936
TR 06	15	Huntingfield	A.J. Chitty	11.vi.1904
TR 241602	15	Preston Court	L.Clemons	15.v.1999
TQ 05	17	Clandon	W.J. Lucas	18.vi.1904
TQ 274677	17	Morden Hall Park	K. Alexander	19.vi.1996
TQ 3275	17	Denmark Hill	G.H. Verrall	21.vi.1912
TQ 3974	17	Hither Green	R.A. Jones	6.vi.1996
TQ 46	16	Hook Farm	P.J. Chandler	1961
TQ 46	16	Oakley Farm	P.J. Chandler	1963
TQ 558683	16	Horton Kirby	L. Clemons	12.vi.1999
TQ 5678	18	Dolphin Quarry	C.W. Plant	1996
TQ 589785	18	Chafford Hundred	J.W. Ismay	19.v.1997
TQ 590783	18	Chafford Hundred	J.W. Ismay	19.v.1997
TQ 594786	18	Chafford Hundred	J.W. Ismay	19.v.1997
TQ 595786	18	Chafford Hundred	J.W. Ismay	19.v.1997
TQ 598793	18	Chafford Hundred	J.W. Ismay	18.vi.1999

Grid. Ref.	VC	Locality	Collector	Date
TQ 67	16	Dartford	J.W. Yerbury	13.vi.1909
TQ 6173	16	Northfleet	C.W. Plant	1995
TQ 600787	18	Chafford Hundred	J.W. Ismay	10.vi.1999
TQ 604788	18	Grays Chalk Quarry	J.W. Ismay	19.v.1997
TQ 654777	18	Gun Hill	P. Harvey	1999
TQ 883772	16	Grain	L. Clemons	1994
TQ 883772	16	Grain	J.W. Ismay	14.vi.1999
TQ 913655	16	Church Marshes Country Park		1996