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MOSS AND OTHER GRAVE MATTERS

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C.R. Stevenson
111, Wootton Road, King's Lynn PE30 4DJ

Introduction

Churches and churchyards are often prominent components of the Norfolk landscape - much loved and much visited, and increasingly valued for their contribution towards the conservation of the county's biodiversity. They are, of course, cultural artefacts, and as such they interact with the natural world in a variety of ways. Such interactions are complex, depending on a variety of local factors. Here I aim to outline some of the main factors affecting the distribution of bryophytes (mosses and liverworts) in such habitats in Norfolk, and to analyse some of the data obtained from them.

The cultural background

Ecclesiastical history, as it relates to Britain.

Christianity first arrived in Britain in Roman times, though no substantial religious buildings survive from that time. The first churches to survive in numbers are Saxon in age, though the majority of British churches, chapels, cathedrals, and monastic buildings were built later, during medieval times. All of these were built under the direct aegis of the (Roman) Catholic Church.

With the Reformation, substantial numbers of monastic buildings were converted to secular uses, or were demolished and recycled. However, the majority of churches were taken over by the newly Established Church (the Church of England), which continued to build churches, as demand arose – particularly during Victorian times when the major cities were in the process of expansion (Currie, Gilbert & Horsley 1977) – a process which did not greatly affect Norfolk.

It was some time after the Reformation, in the late eighteenth and nineteenth centuries, before most Protestant sects, such as the Methodists and Baptists, started to build their own churches and chapels. The emancipation of Roman Catholics, in the early nineteenth century, saw a revival of building by that body. There are, therefore, a large number of different types of churches and other ecclesiastical structures in existence, ranging in age from Saxon through to modern times.

Burial, and burial markers.

There was a belief in medieval times that salvation was best achieved by being buried in a position close to where the Mass was regularly performed. Ideally therefore burial took place inside the church, as close to an altar as possible. However, there was not nearly enough room for everyone, so the rich gradually reserved these positions for themselves, leaving the poor to be buried outside. Initially, if their graves were marked at all, they probably only had a (biodegradable) wooden cross; later, however, as wealth grew, more and more people were able to afford more permanent stone grave markers. Initially these would have been made from whatever stone could be most easily obtained; since there is a total absence of suitable stone in East Anglia, materials had to be imported.

The structure of grave markers may be as complex as that of buildings. The simplest type consists of a (vertical) stone slab, but there are many variations, the more elaborate structures normally reflecting differences in income (plates 1-3). Burgess (1963) illustrates and describes the main types.

The rise of public cemeteries.

Traditionally, burial had occurred within the churchyard, but – particularly in urban areas – the sheer quantity of burials had raised soil levels to such an extent that, even by the seventeenth century, further burials were becoming difficult. In the early nineteenth century churchyards, particularly in urban areas, often had little or no vegetation growing in them, due to the frequency of disturbance due to burials, matters being frequently rendered worse by local householders emptying their chamber pots into the churchyard (Curl 1980 p. 247). By this period epidemics of diseases such as

cholera, deriving from polluted water supplies, also raised serious public health issues, and indeed such issues are still important (Young, Blackmore, Reynolds & Leavens 2001).

As a consequence public cemeteries were developed. Amongst the most influential of these was Père-Lachaise in Paris, founded in 1804; a rash of public cemetery building followed throughout the UK, notably in the major cities (Curl 1980). The Victorian gardener J.C. Loudon was largely responsible for driving forward the 'Garden Cemetery' movement, which, amongst other things, advocated the grassing over of cemeteries. Country churchyards were, presumably, less noxious, and certainly the presence of mole crickets in Norwich churchyards, in the mid seventeenth century (Richmond 2001) suggests so.

Bryophyte vegetation of churchyards and graveyards

Gilbert (1989) and Wheater (1999), amongst others, have written of the ecology of urban churchyards and cemeteries. In these accounts bryophytes receive only cursory mention.

Mosses live in a variety of habitats. However, only three of these occur commonly in churchyards or cemeteries, *viz.* the epilithic, the epigeic, and the epiphytic. Of these three the epilithic is the most important. A few epixylic species may occur, but the epiossic habitat, though of considerable pharmacological interest, is, alas, too rare to be significant (Belcher & Swale 1998).

1 Epilithic. bryophytes: those colonising rock, or rock-like, surfaces.

There are two major epilithic habitats in churchyards: a) the church or chapel itself, and b) individual grave markers. (Boundary walls may be similar to the walls of the church itself, except they are often more neglected.) Buildings are large, and can be divided into a number of sub-habitats, such as roofs, buttresses and walls; they are often constructed from a variety of rock (or rock like) materials, whilst grave markers are

smaller and usually lithologically uniform. However, from the viewpoint of a bryophyte, these superficial differences may be largely irrelevant.

The chemical composition and texture of a surface, the angle at which it lies, its orientation, and the degree to which it has been weathered, are the important factors controlling colonisation. Rock surfaces, whether walls composed of a variety of rock types, or grave markers composed of a single rock type, present much the same challenges to a colonising bryophyte, i.e. those of getting established, and then surviving.

Only a limited range of rock types occurs in Norfolk. Some of them are suitable for the construction of walls, etc, but none are suitable for detailed carving, such as occurs in window tracery or on gravestones. For these purposes stone had to be imported from outside the county. Churches were high status buildings, so the wealth of a community (or of prominent individuals within the community), could be expressed in a rich or elaborate building constructed largely of imported stone. Poorer parishes used local material more extensively.

The main materials available locally were:

- Ferricretes (geologically recent iron cemented sands and gravels).
- Field stones (mainly flints, but with some other glacial erratics).
- Dressed flint.
- In West Norfolk there are two varieties of local sandstone which have been used in building: brown Cretaceous iron-cemented Carstone, and a hard white sandstone, of similar age, which is used (very locally) around Castle Rising (plate 4)
- Local clays, baked into bricks.
- Some of the harder horizons within the lower Chalk (known locally as Clunch), though this was not usually used in external work, being too frost-prone.
- Blocks of any of the types listed above had to be held together by mortar.

In East Anglia the most frequently imported stones were oolitic limestone and ragstone from Rutland and Northamptonshire, transported across the Fens (Burgess 1963). Post nineteenth century buildings, and tombs, were able to make use of a greater variety of stones, imported cheaply from abroad, or from other parts of Britain.

A wider variety of rock types are used in grave markers. There is little overlap with the materials used for construction work, though bricks are used in the sides of some box tombs. Over most of the county the oldest tombstones are likely to consist of (imported) oolitic limestone. However, some eighteenth century sandstone tombs are also present, the provenance of the stone being unknown.

Nineteenth century improvements in transport enabled a wider variety of rock types to enter the county (Dove 1992); prices also fell, so that even the least wealthy could afford some sort of permanent memorial. Fine grained sandstones (almost certainly of Carboniferous age); white Carrara marble from Italy; both red and grey granites, and dark coloured gabbros are all commonly employed. Slate and polished 'marbles' or limestones only occur sporadically. In the twentieth century a variety of artificial materials have been employed; most of these seem to have been cement based.

Sandstones, igneous rocks such as granites and gabbros, and metamorphic rocks such as slates are all acid and poor in nutrients, whereas limestones and marbles are calcareous. Limestones are most easily attacked by the processes of weathering (Lal Gauri & Bandyopadhyay 1999), whilst the other rocks mentioned, including marbles, all weather more slowly – especially if, as is the case in many instances, they have been polished. Highly polished granites and gabbros may take centuries before they show any obvious signs of weathering.

On vertical surfaces water is going to drain away much more quickly than on sloping surfaces; in general, the gentler the angle of slope, the richer the bryoflora potentially may be, though completely flat surfaces, such as the

tops of box tombs, may be sparsely colonised, unless set at ground level. This means that quite small stylistic differences in the shape of a grave marker can be bryologically significant, as can levels of neglect: a leaning stone is much more likely to have a bryophyte cover than one which is completely vertical. Even indentations made by lettering, where moisture collects, may favour moss growth (plate 5), and the base of a stone, down at ground level, may be significantly damper and cooler than its exposed top. However, exceptionally heavy rainfalls may physically detach moss from surfaces, notably roofs, whence they may reach ground level via gutters and drains. The species most affected by this process are the cushion formers (cover plate) which, when saturated, have a higher mass: surface of attachment ratio. The disintegration of these cushions after rainstorms may aid in dispersal, and their growth form might almost be considered a reproductive strategy.

Darlington (1981) and Duchoslav (2002) give concise accounts of the factors which influence the colonisation of walls by vascular plants; many of the same points also hold true for bryophytes, though as they can survive long periods of drought (Proctor 2000), some species are capable of colonising surfaces which vascular plants could not. Darlington (*op cit.*) discusses briefly some of the mosses associated with walls. However, high, vertical walls, such as make up the main fabric of church and chapel buildings, are generally too dry even for bryophytes to cope with, and colonisation is largely restricted to sloping ledges and buttresses, areas beside cracked down pipes, and wall bases. North facing walls and slopes are usually moister than those facing south, and so generally support richer bryofloras, both in terms of diversity and cover. On the southern side of many churches the species most often present include *Syntrichia intermedia, Grimmia pulvinata, Tortula muralis, Orthotrichum anomalum, and Homalothecium sericeum.* Species of *Didymodon*, and other pleurocarps are more frequent on the north side. (Nomenclature follows Blockeel & Long 1998.)

To some extent the bryophytes that are associated with churchyards may be associated with *any* man made structure. However, until comparatively recently, churches were the largest such structures around, and even today most of them are constructed from a more varied range of geological materials than any buildings of comparable scale. Also, given the age of many churches, the rock surfaces have had longer to weather and release whatever nutrients they contain.

Bryophytes growing on rock divide into two main groups: the *obligate* species, which can *only* grow on rock, and the *facultative* species, which mainly grow on rock, but may also occur on other substrates (Smith 1982). (These categories are not wholly satisfactory since patterns of behaviour may change geographically.) In addition there are a wide range of species that can, and do, grow on rock without having any marked preference for it as a substrate, i.e. they are only *occasional* epiliths.

The epilithic species that occur in Norfolk churchyards and cemeteries are listed in table 1.

Table 1. Obligate, facultative and occasional epiliths occurring in Norfolk churchyards & cemeteries.

OBLIGATE EPILITHS

Bryum radiculosum
Didymodon luridus
Didymodon rigidulus
Didymodon vinealis (see plate 8)
Grimmia trichophylla
Hygrohypnum luridum
Orthotrichum anomalum (see plate 7)
Orthotrichum cupulatum
Pseudocrossidium revolutum
Racomitrium aciculare
Rhynchostegiella tenella
Rhynchostegium murale
Schistidium crassipilum
Tortula marginata

FACULTATIVE EPILITHS

Brachythecium velutinum
Bryum capillare
Grimmia pulvinata (see plate 9)
Homalothecium sericeum (see plate 10)
Neckera complanata
Porella platyphylla
Syntrichia intermedia
Tortula muralis
Zygodon viridissimus

OCCASIONAL EPILITHS

Amblystegium serpens
Brachythecium rutabulum
Bryum argenteum
Campylopus introflexus
Ceratodon purpureus
Didymodon sinuosus
Eurhynchium praelongum
Hypnum cupressiforme
Hypnum resupinatum
Orthotrichum diaphanum
Rhynchostegium confertum

Bold = acidophile species

None of these species are confined to churchyards, but the habitat is important for all of them. And given that Norfolk has virtually no natural stone outcrops, most of the obligate or near-obligate species would be very rare, were it not for human building activities. (The same holds true for large areas of central Europe.)

In the remoter past, churches were almost the only stone buildings around - and therefore the only possible sites for colonisation by epiliths. They would then have acted as centres from which bryophytes could have spread outwards onto other buildings, once stone constructions became more common. It is interesting to speculate how the original epiliths arrived in Norfolk: the 'spore rain', from further west is one possibility, as is importation on dressed stone from out of the county. It is likely that some parts, such as windows, were made near the quarry and then assembled on site.

The often very erratic distribution pattern of mosses between churchyards indicates that spread within the county, and between sites, is not very efficient. Sandstone and granite grave markers show a curious absence of colonisation. One explanation for this may be that they are simply too far from the main sources of acid loving mosses in western Britain for spores or other propagules to make the journey successfully – though it should be noted that, until fairly recently, more-or-less severe air pollution may have had an adverse effect on establishment rates. Survival rates, in the 'continental' climatic conditions of East Anglia (Grove, 1961), may also be low. Transplantation experiments could be productive, as a way of determining the relative importance of some of these factors.

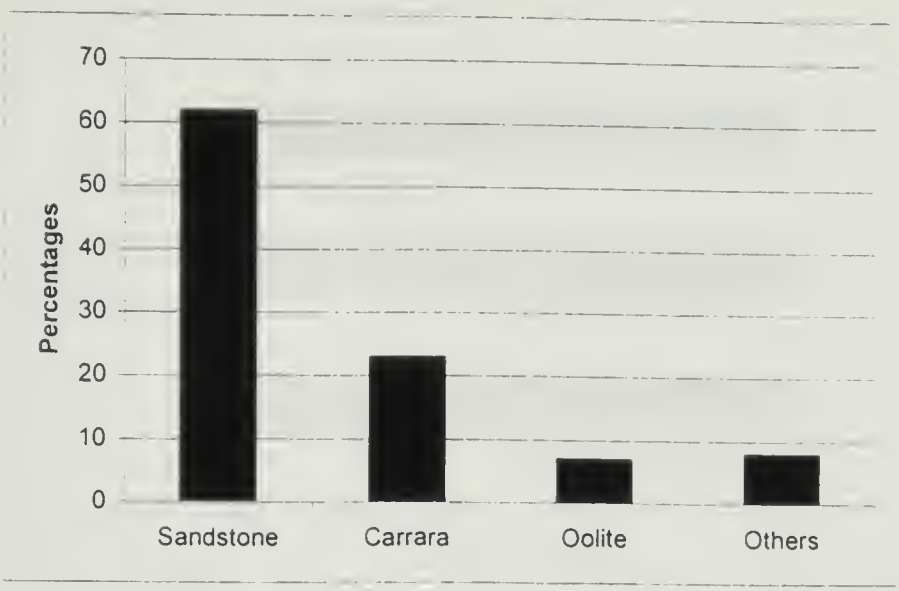


Figure 1. The lithological composition of gravestones in East Dereham Cemetery

The number of gravestones increases as time goes on, and there are accompanying changes in the proportion of different types of stone used. For instance, in the public cemetery at East Dereham, which was founded in 1869, out of a total of 267 stones examined, 62% were sandstone, 23% Carrara marble, 7% oolite, small numbers of granite and slate making up the remainder (figure 1). The rather poor selection of lithologies present, with the preponderance of cheap sandstone, probably reflects the social status of those being buried there in late Victorian times.

The number of mosses present varied with rock type (figure 2). Of the sandstone memorials, 92% had no moss at all growing on them; where it did occur, it was only at the very base of the stones, and a very limited flora of only three species was present. Of Carrara marble stones, 62% bore no mosses at all. On the remaining 48% 3 or fewer species occurred per stone, although a somewhat wider range of (9) species were present. Of these *Orthotrichum diaphanum* was commonest, mainly growing on the upper parts of the stones, where perching birds and drip from overhanging trees may have enhanced nutrient levels.

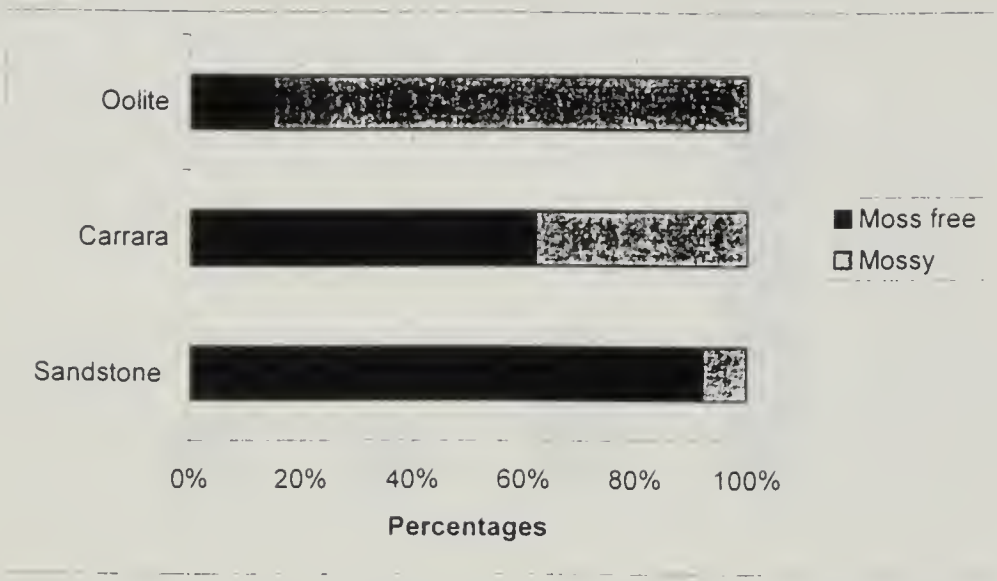


Figure 2. Bryophyte cover, by lithology, in East Dereham Cemetery

The presence of so many oolite stones was fairly surprising. They were also, however, by far the richest in mosses, only 3 individual stones bearing no moss. The majority of the stones (70%) had 3 or fewer species growing on them, only 15% having as many as four species. The range of species present, at 11, was, however, the greatest (table 2). The grey shading indicates species confined to a single rock type; however, these data relate to a single cemetery. Experience elsewhere suggests that none of these species is confined to any single rock type, though *Rhynchostegiella tenella* is more commonly found at the base of oolite tombstones than anywhere else. Further analysis might show other preferences.

These results illustrate the general principles that a) limestone normally supports the richest bryofloras, and b) cultural factors, such as transport, and changing tastes, have a marked influence on what can grow. When c) the growth position was taken into account, the majority of bryophytes associated with the 'poor' rock types, occurred either at the base of the stone (where humidity levels are highest), or, in the case of more elaborate structures, at those points where structural units were held together by

cement. Occasional epiliths are largely confined to humid positions near ground level.

Table 2. The distribution of moss species according to lithology in Dereham Cemetery.

Moss species	Sandstone	Oolite	Carrara Marble
Amblystegium serpens		•	
Brachythecium rutabulum	•	•	•
Bryum capillare		•	•
Eurhynchium praelongum	•	•	
Grimmia pulvinata		•	
Hypnum cupressiforme		•	•
Hypnum resupinatum	•		•
Orthotrichum anomalum		•	•
Orthotrichum diaphanum			•
Rhynchostegiella tenella		•	
Rhynchostegium confertum		•	•
Syntrichia intermedia			•
Syntrichia ruralis		•	
Tortula muralis	•	•	•

In the Hardwick Road cemetery in King's Lynn a sample of roughly the same size and age range was examined. The proportion of more expensive Carrara marble was very much higher (85%), whilst sandstone sank to 5.5%: these differences may reflect differing levels of prosperity between Lynn and Dereham at the time. Bryologically, however, this portion of the King's Lynn cemetery is even duller than Dereham, partly because of the lack of oolite, but possibly also because of the lack of trees. (In the northern part of the Lynn cemetery there is a higher percentage of older, more elaborate, oolite graves, and the flora is therefore richer - emphasising the importance of micro-environmental abiotic heterogeneity for bryophytes? (Wilson 2000).)

Roofs: Locally used roofing materials include lead, pantiles, slate, thatch and corrugated iron. The bryophyte flora of roofs is poorly known since they are usually inaccessible, and even with good binoculars identification

of plants is not easy. Often material washed down gutters, or scratched off by birds, is all that is available for study.

Where roofs are made of lead, then no bryophytes at all occur. Hard materials such as slate and tile support few bryophytes though some of the large pleurocarps can, once established, cover quite large areas; such species as are present tend to occur along the joins between slates. Acidophile species such as *Campylopus introflexus* may occur infrequently on roofs. Aspect appears to be important: it is very obvious that the south facing roof of the modern Catholic Chapel of Reconciliation at Little Walsingham, carries more moss than the north facing side – which is odd, given that the north sides of churches are generally richer. More detailed observations of this habitat need to be made.

Soft organic materials, such as thatch, are potentially capable of supporting richer communities. However, thatched roofs are generally well maintained nowadays, and the use of fire-retardant chemicals, and wire netting, from which zinc is liable to leach, mean that most thatch roofs are nowadays bryophyte poor, only toxi-tolerant species, such as *Pohlia nutans* and *Ceratodon purpureus* being able to survive. The thatched roof at Horsey Church is totally covered on the north side with *Pohlia nutans*.

2. Epigeic bryophytes: those colonising soil surfaces.

Epigeic mosses are restricted to those occurring in grassland, or on the exposed soil of new graves, flowerbeds, paths, etc. These species are generally related quite specifically to the underlying soil conditions which, because of the glacial history of the county, may vary over short distances. However, the soil in churchyards has probably been considerably modified over the centuries: that in public cemeteries, which has been less disturbed, may be more 'natural'. Soils will be subject to periodic disturbance by sextons, moles, rabbits, and earthworms, all of which may produce bare patches open for colonisation by bryophytes.

The greatest area of most churchyards, however, is covered by grass, subject to varying degrees of management. No systematic study has been

made of the vascular plants in Norfolk churchyards, but it is obvious that in some instances, the vegetation is more 'natural' than in others, with a variety of vascular grassland species being present. Elsewhere, swards of apparently uniform grass presumably represent the efforts of zealous churchwardens holding, with John Wesley, the view that Tidiness (if not actual Cleanliness), is next to Godliness. Bryophytes are mostly associated with unimproved grass, though a few species may persist, even in the most carefully managed situations.

Some of the soil species which occur are ephemerals, which typically occur in disturbed ground such as arable fields. They include acrocarpous species such as *Tortula acaulon, Bryum rubens, Bryum subapiculatum, Microbryum starckeanum,* etc. It is, obviously, a matter of luck (and timing) whether any of these species are found in particular graveyards, unless the management regime includes spraying the base of tombstones (this eliminates competition by vascular plants). They must, of necessity, employ reproductive strategies which enable them to move about between fairly short-lived habitat patches (During 1992). Other species, such as *Fissidens taxifolius* and the pleurocarps *Amblystegium serpens, Brachythecium rutabulum, Eurhynchium hians* and *E. praelongum* are associated with more stable soil conditions. Acrocarpous mosses tend to grow upright, form tufts or carpets, and possess few side branches. Pleurocarpous mosses sprawl and produce numerous side branches – see plates 7-10 for illustrations of these growth forms.

Another group of species are associated with lawns and grasslands. *Rhytidiadelphus squarrosus* and *Scleropodium purum*, which occur in many domestic lawns, occur, respectively, in 45% and 41% of the sites examined, with a 43% co-occurrence. Other species, however (e.g. *Thuidium tamariscinum, Plagiomnium undulatum)* are sometimes regarded as being characteristic of woodland habitats. If they are indeed relict species, this may be an indication of former woodland close to the churchyard, or from which it was enclosed. It is more likely, however, that these species (which occur almost unfailingly on the north side of the church) survive there because of the high levels of moisture.

A specialised habitat that deserves mention is shingle, or shingle substitutes, in particular the coloured glass that used to be spread quite frequently on kerbed graves in the latter part of the last century. Its purpose was to suppress weed growth, and thus ease maintenance of the grave; however, if neglected, it can 'moss over' quite nicely. (Are the bryophytes growing here epiliths, or epigeits?) Gilbert (1989) suggests that 'Where shrouded by dense ground vegetation or trees, communities of bryophytes typically dominate' in this habitat; my experience is that neither of these conditions is necessary for bryophytes to dominate. Species characteristically found in this habitat include *Bryum capillare, Dicranum scoparium, Scleropodium purum* and *Syntrichia ruralis* – all species which are equally at home on well drained sand dunes.

3. Epiphytic bryophytes: those attached to vascular plants such as trees and bushes.

Epiphytic bryophytes are favoured by certain types of bark chemistry and texture, and by conditions of high humidity. These are rarely met with in churchyards.

Yew trees have long been associated with churchyards, as have conifers, following the precepts laid down by J.C. Loudon; he felt their sombre, funereal colours were peculiarly appropriate to burial grounds (Loudon 1843). On a more practical note, they also avoided the management problems associated with deciduous leaves in autumn. The bark of conifers, however, is generally unsuitable for colonisation by mosses – especially in dry areas such as East Anglia. Even where a wider variety of trees is found, and in country areas native trees often occur around the edges of the site, in general the spacing of trees is seldom sufficiently close to affect the microclimate much, except in overgrown, neglected areas, where dense trees will act as windbreaks.

The leaf drip through a tree canopy will be enriched with leached material, and in some instances this has an obvious effect on moss growth, particularly where trees overhang otherwise nutrient poor wall tops or gravestones. This is only true of deciduous species; conifer throughflow is

acid and nutrient poor. On the other hand leaf litter may have an adverse effect on moss growth underneath trees, mosses only surviving on protruding tree roots.

Epiphytes are often assumed to be particularly susceptible to the effects of air pollution, so it is worth noting that urban churchyards are at least as rich as rural ones. This reinforces the idea that lack of habitat is the most significant feature.

4. Epixylic bryophytes: those attached to dead or decaying wood.
If rotting wood, in the form of old wooden crosses, roofing shingles, usually on Lych-gates, tree stumps, etc exists, then species such as *Dicranoweisia cirrata, Ceratodon purpureus*, *Campylopus introflexus* and *Aulacomnium androgynum* may colonise them. Most churchyards are devoid of such material, though local pockets of wooden crosses do exist, reflecting a temporary fad in taste. Again, cultural factors mediate the bryology.

The management of churchyards and graveyards
As noted above many nineteenth century urban churchyards probably carried little by way of vegetation, whilst in rural churchyards maintenance was probably achieved by occasional scything or grazing by sheep – a practice which continues in some areas.

The Victorian obsession with death (Curl 1972) brought in new standards of management. In urban areas fewer and fewer interments took place in churchyards, as the size and scope of cemeteries grew. This allowed some redevelopment of churchyards to occur, and many lawns and tree plantings probably date from around this time. In rural areas, such as most of Norfolk, little change probably occurred, except for more planting of non-native conifers and shrubs.

Cemeteries, whether civic or commercial, set expectations of standards of layout and maintenance which rising costs, in the latter part of the last millennium, gradually rendered unrealistic. Some urban cemeteries have degenerated into secondary woodland; most Norfolk cemeteries have not

degenerated to this extent, but changes in management practise have had to take place to accommodate rising costs.

In both rural and urban churchyards the twin desires for neatness and ease of management have led to the removal of gravestones, and their re-arrangement, either around the edges of the site, or in back-to-back rows, enabling greater ease of mowing. Spraying the base of stones, so as to suppress vascular plant growth, makes mowing easier but also opens up opportunities for colonisation by epigeic species. Another management strategy has been to embrace 'conservation', and set aside part of the site for this purpose, whilst elsewhere churchwardens have deliberately set about cleaning the fabric of both the buildings and the gravestones of mosses and lichens, on the grounds that they are unsightly.

Particularly in cemeteries operated by local authorities, health and safety issues have become important leading to the demolition of those structures deemed to be in an unsafe state: since these are likely to be the older, better weathered stones the effect on moss populations is likely to be deleterious.

Graves may also be turfed or sown as soon as possible after interment to ease maintenance (Gilbert 1989. p.221) whilst the use of plastic sheeting to contain the earth means that post-burial restoration work is generally neater, resulting in fewer areas of open soil.

Analysis

Norfolk contains around 650 Anglican churches and chapels (Reynolds 1996). The number of buildings belonging to other denominations is unknown, but is presumably of the same order of magnitude. Of these 258, mainly Anglican, churches have been recorded. Not all of the sites have been recorded in the same detail, some older records (compiled during recording for the Flora (Beckett, Bull & Stevenson 1999)) consisting purely of species lists. The data set generated by this study is too large to print. Anyone interested in obtaining a copy should contact me. It is proposed to put the data onto a website at some stage in the future.

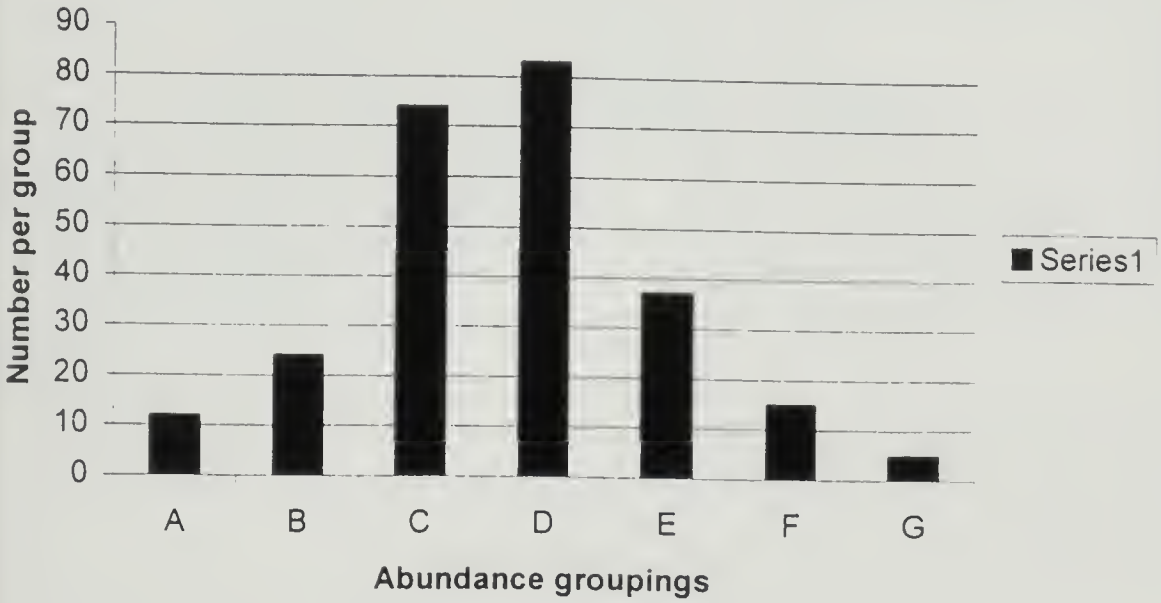


Figure 3. A histogram showing the relative species richness of the Norfolk graveyards sampled. A = <5; B = 6; C = 11-15: D = 16-20; E = 21-25; F = 26-30; G = 31+

The lowest number of species recorded was 9, a number found in several churchyards; the highest was 33 (St Mary's, Little Walsingham). The mean number of mosses per churchyard is 16. As figure 3 shows, the distribution of numbers of species shows a more-or-less normal distribution curve, i.e. there are a small number of very poor churchyards, a few very good ones, and the rest lie somewhere in between. (Non-conformist sites have not been sampled, other than casually; however, they appear to be distinctly poorer - the Baptist Chapel in East Dereham, for instance, was totally moss-free. This could be because most non-conformist churches have no attached burial ground, and are also largely made of brick. More sampling is needed. Where, as in the case of The Trinity Methodist church in East Dereham, the building is made of stone and there are surrounding grounds, then the total bryoflora can surge to around the county average.

Absolute numbers, however, are only part of the story. At All Saints & St Mary (Great Melton) for instance, a policy of spraying round the base of the gravestones was obviously in place: the lack of vascular plants meant that a higher than normal proportion of the bryoflora was made up of epigeic species. The churchyard as a whole came out with a good total flora (27), but all the species were very widespread and lacking in distinction. Marlingford, on the other hand, had only 19 species present, but that total included *Leucodon sciuroides* – a very noteworthy plant.

One hundred and twenty - two different species of bryophytes have been found in Norfolk churchyards; this is roughly 26% of the total bryophyte flora for the county (28%, if one excludes the very specialised Sphagna or bog-mosses). The distribution of the species amongst the churchyards shows an interesting pattern (figure 4): the bulk of the species occur in a very small number of localities (often only a single site), whilst the number that occur very widely is small. In essence the differences between churchyards are liable to be greater than the similarities.

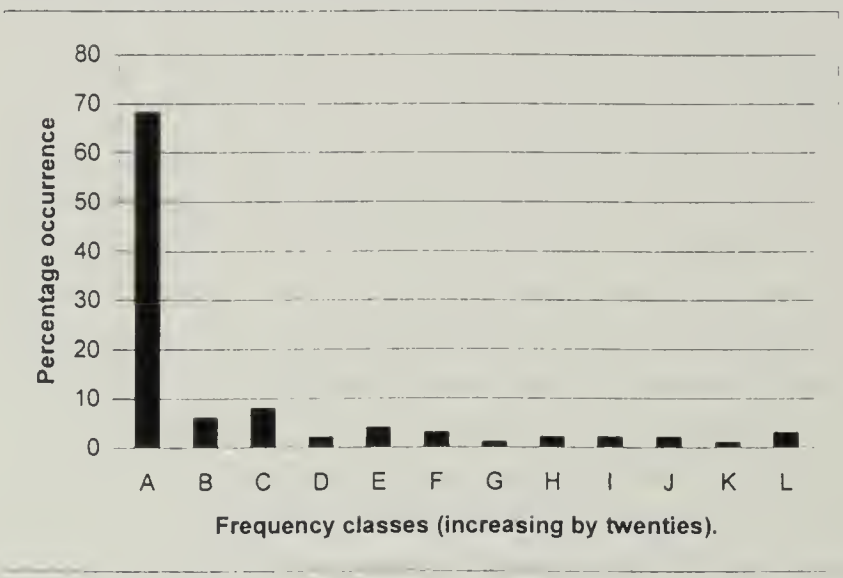


Figure 4. The percentage of species occurring in each frequency class. Column A shows that 68% of species occurring in Norfolk churchyards are found in fewer than 20 localities. Column L shows that only 3% of species are to be found in more than 220 sites.

Cushions of the moss *Syntrichia intermedia* on the south facing slope of a buttress - a characteristic habitat. A typical acrocarp.

t the top of the photograph can be seen shoots of the pleurocarpous moss *Hypnum cupressiforme*. whilst at the ottom the apple green shoots of the acrocarp *Didymodon vinealis* are visible.

Another acrocarp, the facultative epilith *Grimmia pulvinata*.

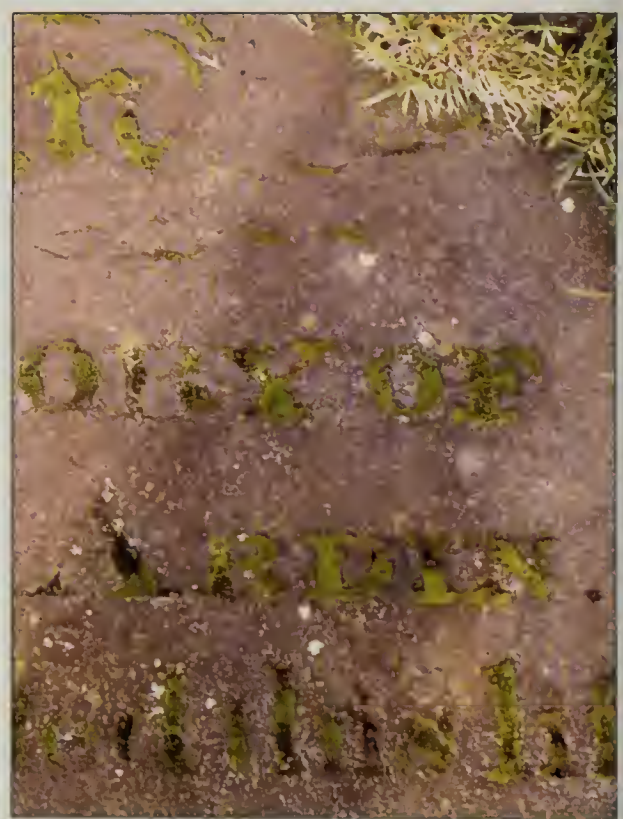
This picture of the pleurocarp *Homalothecium sericeum* shows the typical way in which pleurocarps extend laterally, with many side branches.

Downham Cemetery. The plain upright slab in the foreground is only likely to have moss at its base. The more elaborate urns and other structures in the background are likely to have greater moss cover.

his variant of the Box or Chest tomb has gently sloping upper surfaces. Made of oolite, it has acquired a rich overing of moss.

This kerbed grave shows clearly how the well drained shingle filling has acquired a good moss cover, as have the low kerbs themselves.

A piece of the wall of South Wootton church, showing a variety of local building materials, including dark gravelly ferricete, local white sandstone and flint.



Tortula muralis, nestling in the slightly moister incised lettering of a horizontal slab, illustrates the fine controls which influence the growth of mosses.

Only eight species occur in more than 75% of churchyards, with a further four species occurring in more than 50% of sites (table 3). These are all species which are common throughout the British Isles, on a variety of substrates. Seven of the twelve species listed have very wide ecological tolerances, and can occur on soil, stone, or as epiphytes. The remainder have more specialised habitat needs.

Most of these species are not only widely distributed, but they are also common within sites. However, in some cases they are either absent, or rare - which raises the question 'Why?' They may, of course, have been overlooked, but this is unlikely to be the case in all instances.

Table 3. The Commonest Species Occurring In Norfolk Churchyards

Species	**Percentage occurrences**	**Principal habitat(s)**
Tortula muralis	92	Mainly an epilith
Bryum capillare	89	Very varied
Grimmia pulvinata	89	Mainly an epilith
Brachythecium rutabulum	85	Very varied
Homalothecium sericeum	82	Mainly an epilith
Eurhynchium praelongum	77	Very varied
Rhynchostegium confertum	75	Very varied
Didymodon vinealis	65	Mainly an epilith
Syntrichia intermedia	64	Mainly an epilith
Hypnum cupressiforme	59	Very varied
Amblystegium serpens	56	Very varied

The rarest species are those which occur in fewer than 2% of churchyards (table 4). They include a few species which are rare in the county as a whole (i.e. occur in fewer than 8% of the total number of 10km squares in the county (Beckett, Bull & Stevenson 1999)), the bulk, however, occur much more frequently. The bulk of these 'rare' churchyard species consist of epigeic plants, such as are common in stubble fields (indicating that disturbed ground is not as frequent within churchyards as one might suppose), and a few epiphytes. Table 5 lists examples of species which, whilst common in the county as a whole, are rare in churchyards.

Table 4: The rarer bryophytes of Norfolk churchyards & cemeteries.

Rarities within the county have been **emboldened.**

Species	No. of sites	Habitat	Species	No. of sites	Habitat
Aloina aloides	1	soil	*Leptodictyum riparium*	1	wet/damp habitats
Aulacomnium androgynum	5	rotting wood	*Leucodon sciuroides*	2	epilith
Brachythecium mildeanum	3	soil: grassland	*Microbryum davallianum*	1	soil
Brachythecium populeum	1	varied	***Microbryum starckeanum***	2	soil
Bryoerythrophyllum recurvirostrum	3	varied	*Mnium hornum*	4	saried
Bryum klinggraefii	1	soil	*Orthodontium lineare*	1	epiphyte
Bryum subapiculatum	3	soil	*Orthotrichum affine*	5	epiphyte
Campylopus introflexus	2	varied	*Orthotrichum pulchellum*	1	epiphyte
Cirriphyllum piliferum	4	soil	*Pleuridium acuminatum*	1	soil
Cratoneuron filicinum	3	varied	***Pleuridium subulatum***	1	soil
Dicranella heteromalla	5	soil	*Pohlia melanodon*	1	soil
Dicranella schreberiana	1	soil	*Pohlia nutans*	4	wide
Dicranella staphylina	2	soil	*Polytrichum formosum*	1	soil
Dicranella varia	2	soil	*Polytrichum juniperinum*	2	soil
Didymodon fallax	4	soil	***Racomitrium aciculare***	1	epilith
Didymodon tophaceus	1	varied	*Rhytidiadelphus triquetrus*	2	grassland
Didymodon umbrosus	2	epilith	*Syntrichia virescens*	1	epiphyte
Ditrichum cylindricum	1	soil	***Tortula marginata***	2	epilith
Eurhynchium pumilum	1	soil	*Tortula modica*	3	soil
Eurhynchium striatum	4	soil	*Tortula protobryoides*	1	soil
Fissidens adianthoides	2	soil	*Tortula truncata*	1	soil
Fissidens incurvus	1	soil	*Weissia controversa*	2	soil
Fissidens pusillus	2	soil	***Weissia longifolia***	1	soil
Fissidens viridulus	3	soil			
Grimmia trichophylla	1	epilith	*Calypogeia fissa*	1	soil
Gyroweissia tenuis	1	epilith	*Conocephalum conicum*	1	soil
Hennediella macrophylla	1	soil	*Metzgeria fruticulosa*	1	epiphyte
Homalothecium lutescens	4	grassland	*Metzgeria furcata*	3	epiphyte
Isothecium alopecuroides	1	epiphyte	*Radula complanata*	1	epiphyte
Leptobryum pyriforme	1	soil	*Reboulia hemisphaerica*	1	soil

Table 5. Species which occur in more than 70% of 10km squares in the county, but are rare, or less common than might be expected, in churchyards.

Species name	% occurrence in 10km squares[A]	% occurrence in churchyards[B]
Atrichum undulatum	70	2
Aulacomnium androgynum	77	2
Barbula convoluta	97	28
Barbula unguiculata	97	31
Brachythecium albicans	80	6
Bryum argenteum	95	31
Bryum bicolor	87	21
Bryum rubens	74	10
Calliergonella cuspidata	87	22
Campylopus introflexus	74	2
Ceratodon purpureus	95	39
Dicranella heteromalla	80	2
Dicranoweisia cirrata	85	20
Dicranum scoparium	77	5
Eurhynchium hians	80	16
Fissidens taxifolius	74	1
Funaria hygrometrica	93	13
Mnium hornum	74	1
Orthodontium lineare	73	0.3
Orthotrichum affine	73	2
Tortula acaulon	83	16
Plagiomnium undulatum	80	22
Polytrichum juniperinum	71	1
Syntrichia ruralis	77	22
Lophocolea bidentata	78	3
Lophocolea heterophylla	76	15

[A] Many of these species, particularly those in the high 80s and 90s probably have a 100% occurrence, their current standing merely reflecting minor recording gaps.

[B] The distribution of churchyards recorded has not been evenly spread geographically, although most 10km squares have been sampled at least once. Churches are not evenly distributed, and there has also been a recording bias towards areas in the west of the county, nearer to King's Lynn.

What such lists do not tell, however, is what the real relationship is between occurrence within, and outside, churchyards. There are a substantial number of species which are 'common' in the county, according to the published criteria (Beckett, Bull & Stevenson 1999), but whose presence *outside* a churchyard is noteworthy. The bulk of them are epiliths, either Obligate or Facultative (as listed in table 1). Most of the 'rarities' encountered within churchyards are not really rare at all, being common elsewhere, whilst some of the 'common' species of the county are only common because they occur in so many churchyards!

Phytogeographical analysis.

The Norfolk bryoflora was analysed, using the data in Hill & Preston (1998) This shows that the Norfolk bryoflora is composed of species from a number of different phytogeographic elements. A similar analysis of the bryoflora associated purely with churchyards reveals some possibly significant differences (table 6): those elements associated with colder climatic conditions are conspicuously absent from churchyards, whilst there is generally a notable level of enrichment amongst those species associated with warmer climatic conditions. This could be because of the preponderance of well lit stone and shallow soil habitats.

Table 6: A phytogeographical analysis of Norfolk churchyard bryophytes.

No. in churchyards	Category	% Church	% County	% Difference
0	Boreo-arctic	0	6.3	- 100%
3	Wide-boreal	2.5	4.6	- 46%
0	Boreal-montane	0	6	- 100%
32	Boreo-temperate	27	31	- 13%
16	Wide temperate	13	5.5	+ 57%
37	Temperate	31	29	+ 6%
17	Southern temperate	14	8.6	+ 38%
15	Mediterranean	12.5	9	+ 28%
120	**TOTALS**	**100%**	**100%**	

The shading emphasises positive differences from the county average.

Urban areas are known to experience more-or-less markedly different microclimates than the surrounding countryside, being generally warmer

and wetter (Landsberg 1981). (A local example of the effect of this on urban vascular floras is provided by Chater, Oswald & Preston (2000).)

The urban bryoflora of King's Lynn does differ from that of the rest of the county (table 7), but churchyards appear to show a much more consistent enrichment in thermophilous elements. This, presumably, is due to their restricted areas; in urban areas, micro-habitats offering shelter to plants characteristic of cooler micro-climates may be more frequent.

Table 7: A phytogeographical analysis of the urban bryoflora of King's Lynn.

Number	Category	% King's Lynn	% County	% Difference
0	Boreo-arctic	0%	6.3%	- 100%
8	Wide-boreal	5.8%	4.6%	+ 20.5%
1	Boreal-montane	0.5%	6%	- 91%
39	Boreo-temperate	27.5%	31%	- 11%
14	Wide temperate	9.6%	5.5%	+ 43%
55	Temperate	39%	29%	+ 25%
14	Southern temperate	9.6%	8.6%	+ 10%
11	Mediterranean	8%	9%	- 11%
142	**TOTALS**	**100%**	**100%**	

The wider perspective

Such information as is available on the bryology of cemeteries is summarised in table 8. I have not found any other accounts of the bryophytes of cemeteries in Britain, hence the bias towards central Europe. However, as East Anglia allegedly has a 'Continental' climate, this is not a problem.

The figures for Bratislava, King's Lynn and Lublin relate to single cemeteries; the figures for Berlin, Norwich, Poznan, Szczecin and Wroclaw, however, relate to groups of cemeteries, scattered across the urban area. As is to be expected, there are differences between the towns, although a surprisingly large number of species are common to all. Examples include species such as *Brachythecium rutabulum, Eurhynchium hians, Grimmia*

pulvinata, Hypnum cupressiforme, Orthotrichum anomalum, Orthotrichum diaphanum, and *Tortula muralis.*

Table 8. A comparison of the numbers of bryophytes in some European cemeteries.

City	Population	Number of bryophytes	Reference
Berlin	3, 388, 434	110	Shaepe (1986)
Wroclaw (Breslau)	643, 000	63	Fudali (2001)
Poznan	583, 000	77	Fudali 2002
Bratislava	450, 000	34	Janovicová (1998)
Szczecin (Stettin)	419, 600	64	Fudali (1996, 1997)
Lublin	353, 000	7	Karczmarz Swarowski (1998)
Norwich	185, 20	41	
King's Lynn	41, 281	31	

Some of the differences that occur between Norfolk and central Europe are due to the presence of different species. Some are due to differences in soil type, some to the presence / absence of specific microhabitats: Fudali (1996), for example, records *Physcomitrium pyriforme* from a cemetery – on the embankments of a pond – not a normal feature of most cemeteries. Again, this emphasises the importance of environmental heterogeneity. What is notable is that the Norfolk cemeteries a) compare favourably in number with many of the continental sites, despite being much smaller, and b) cemeteries, despite being usually much bigger than most parish churchyards, are not notably richer in species.

Bratislava, Lublin and Wroclaw are the nearest of these cities to upland areas in which one might expect there to be natural outcrops of rock; it would be interesting to know more of the geology of the gravestones involved, and what degree of overlap there is with naturally occurring epilithic communities in the region. In Wroclaw graves, paths and grounds are regularly cleaned and maintained, sometimes with industrial cleaners

(Fudali 2001, and personal communication). Many older graveyards were destroyed during the last war. Rural churchyards are possibly richer, since older graves are likely to have survived in greater numbers, although a lack of stone, and low rural incomes, might mean that greater use was made of wooden grave markers.

The future

It is surprising that the bryophytes in churchyards have not been studied more intensively. Churchyards, in rural areas anyway, have been managed in much the same way for centuries, and have not been subject to the severe seral changes which have affected many more 'natural' habitats. These factors would appear to make them ideal for investigations into colonisation, etc. Söderström (1998) has commented on the lack of long term studies into population dynamics in the field – churchyards would appear to be ideal for such studies.

However, it is likely that rates of change in management regime will accelerate in the future. Increased leisure and affluence mean that higher levels of tidying may become the norm, unless churchwardens can be educated to exercise a degree of restraint. Concerns about health and safety may accelerate the trend towards dismantling 'unsafe' grave markers, or moving them to marginal positions – which also facilitates management.

Changing fashion in methods of burial may also prove significant: cremation is much more popular, the only reminder of the deceased usually being a small marker slab, set at ground level. These will be easier to move once living relatives cease to tend the site, and, in any case are unlikely to offer many opportunities for moss colonisation, other than by occasional epiliths. The use of hard, exotic, igneous rocks has also increased. Their highly polished surfaces will weather extremely slowly, and are unlikely to offer habitat to either bryophytes or lichens within the foreseeable future. There has, however, been an increasing recognition of the alien and unsuitable nature of such materials, and many dioceses have now offered directives to clergy, recommending that only local or traditional stone types be permitted within graveyards. Personal observation suggests that, in many

areas, little heed is being paid to these directives. Within public cemeteries no such strictures apply, and they seem destined to become bryophyte deserts.

Another factor to be considered is global climate change. Warming climates are likely to accentuate the previously noted trend for thermophilous species to cluster in churchyards, whilst increasing numbers of visitors to churches increase the likelihood of introducing alien species from southern areas: such introductions are most likely to occur in urban centres first, and the presence of the oceanic southern-temperate species, *Didymodon umbrosus*, on the walls of St. George, Colegate (Norwich), and between paving slabs at St Faith's, Gaywood (King's Lynn), may be among the first signs of this.

Changing weather and wind patterns may also affect the spore rain, which, it is claimed, is responsible for some of the 'odd' species which turn up from time to time, but which never succeed in spreading – *Racomitrium aciculare* in the Rosary Cemetery in Norwich being a good example.

Air pollution, due to sulphur dioxide, was widely cited as having had an influence on (particularly) epiphytic bryophytes. The latest causes for concern appear to be ozone and atmospheric nitrogen deposition, e.g. Bates (2000) and Lee *et al.* (1998). Most pollution studies seem to have concentrated on the effects on a few well-studied species, none of which are epiliths.

Conclusions

- If churches and graveyards are good for bryophytes at all, it is only if they contain limestone; acid stone types in Norfolk do not appear to be frequently colonised, regardless of age.
- Preliminary analysis suggests that the bryofloras of churches and churchyards may differ significantly from those in the wider world, being more southern in their affinities.
- Urban churchyards seem, on the whole, to be just as rich as those in rural settings.

- Cemeteries, although generally much bigger than any churchyard, are not appreciably richer in species. Size doesn't appear to matter.

Topics that would repay further investigation include the following:

- Are there any differences in the bryoflora across the county, i.e. from west to east?
- Are there differences between coastal sites, and those inland?
- The detailed biology of individual species: we know almost nothing about the majority of moss species. How do they get to a site? How long do they live? How quickly do they grow?
- How important is aspect in controlling plant distribution? Are there any differences in the phytogeography of communities growing on the south and north sides of churches?
- Comparisons between Norfolk and other areas of Britain and Europe.
- The relationship between rock type, growth position, and species occurrence.
- Thorough testing of the impression that Anglican churches are bryologically richer than those of non-conformist sects.

Personally, I find the fact that we know so little, exciting. I hope that some of you do too, and that you will be stimulated to look at the bryophytes in our Norfolk churchyards more intensively.

Acknowledgements
I have enjoyed the company and intellectual stimulation of many people whilst mossing in churchyards, mostly members of either the Norfolk or Cambridge Bryology groups. Of these Bob Ellis, John Mott, David Strauss, Chris Preston and Mark Hill deserve special mention. Chris Preston was crucial in the development of a churchyard recording sheet. He, and Ron Payne, read this paper in draft form, and made constructive suggestions for its improvement. Ewa Fudali helped too, by supplying separates, pointing me in useful directions, and by answering questions about cemeteries in Eastern Europe. Finally, my wife Wendy deserves special thanks, for her tolerance and gastronomic support.

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Miscellaneous observations

Death of an Emperor. On July 12th, 2002 I was watching the dragonflies at the pond on Beeston Common, near Sheringham. In particular I was watching a female emperor dragonfly (*Anax imperator*) depositing her eggs. As she dipped across the pond a single egg was deposited on to some floating vegetation. The dragonfly was quite close to a moorhen with two chicks and at one point the moorhen darted towards the dragonfly causing the insect to fly off. I initially thought that the bird had 'seen off' a perceived threat to her chicks, given the large size of the emperor, however, the dragonfly returned and resumed egg-laying in the vicinity. Another lunge at the dragonfly by the moorhen resulted in it being caught. Evidently the moorhen had snapped up a substantial meal!

Francis Farrow

A lucky escape. While walking through some scrubby woodland at the southern end of Sheringham Common on July 29th 2002, I became aware of a shrill squeaking. At first I wondered what type of bird or mammal it could have been, then I recollected that I had heard a similar shriek from a common frog being tormented by a cat. I scanned the path ahead and just managed to see a small black and white mammal retreating from a medium-sized frog. The mammal was a water shrew and according to *"Wild Animals of Britain* " by Keith Shackleton, it is known to attack and eat frogs. This was certainly a lucky escape for this particular frog.

Francis Farrow

The banded demoiselle *Calyopteryx splendens* (Harris) was first recorded at Wheatfen in 1994 and in the following years occasional visitors were observed. In early June 2003 over thirty specimens were noted in a 100m length of dyke linking Wheatfen Broad to Deepwaters. Through June large numbers were regularly seen on or around water lily leaves throughout the Wheatfen Reserve, in Rockland Broad, the dykes of the Rockland levels and in the shallower margins of the River Yare.

David Nobbs

WILDLIFE 2000

NORFOLK TERRESTRIAL HETEROPTERA (part 2)

K.C.Durrant
18, The Avenues, Sheringham, Norfolk NR26 8DG

Introduction

In the previous issue of the *Transactions of the Norfolk and Norwich Naturalists' Society* (vol **35**, pt 1., 2002) the overall life cycles and species ecology of the Norfolk terrestrial heteroptera were described. This paper continues the County survey by looking at the stilt bugs, lace bugs, ground bugs, flower bugs, blood suckers and the minute bugs.

HEMIPTERA
HETEROPTERA

Berytinidae Stilt Bugs	**Food**	**Wat/Pre**	**VC**	
Cymus claviculus Fln	toad rush, knotgrass			28
Cymus melanocephalus Fieb	yellow loosestrife, marsh birds-foot trefoil			28
Cymus glandicolor Haln.	watermint, reedmace, sedges	27	28	
Berytinus crassipes H&S	chickweeds			28
Berytinus montivagus Meyr.	black medick		27	
Berytinus signoreti Fab.	birds-foot trefoil		27	
Berytinus minor H&S	restharrow, white clover		27	28
Neides tipalarius L.	Canadian fleabane, tansy, var. grasses		27	28
Gampsocoris punctipes Germ.	restharrow on sand dunes		27	

Figure 1A. *Berytinus minor* H&S. 5.3-6.9mm. The commonest stilt bug usually found on rest harrow and white clover. They overwinter as adults; both macropters and brachypteras are found.

Figure 1B. *Gampsocoris punctipes* Germ. 4-5mm. Usually found in coastal dunes on rest harrow. The nymphs are green, heavily spotted like the adults. Note the spine arising from the scutellum, also shown side view.

Tingidae Lace Bugs

Agramma laeta Fln.	sedges and rushes on salt marshes	27	
Acalypta parvula Fln.	var. mosses	27	
Acalypta carinata Panz.	mosses on rotten logs	27	
Dictyonota strichnocera Fieb.	gorse and broom	27	
Dictyonota fuliginosa Costa	old broom bushes	27	
Derephysia foliacea Fln.	ivy	27	
Dictyla convergens H&S	water forget-me-not	27	
Tingis reticulata H&S	bugle		28
Tingis ampliata H&S	creeping thistle	27	28
Tingis cardui L.	spear thistle, marsh thistle	27	28
Catoplatus fabricii Stal.	oxeye daisy		28
Monanthia humuli Fab.	water forget-me-not		28

Tingidae - Lace Bugs. These remarkable small grey-brown insects are all plant feeders, but their beauty is only appreciated when viewed through a lens or low power microscope. Many of them posses lateral reticulated flanges on their pronotum.

Figure 2A. *Derephysa foliacea* Fln. Ivy Lacebug. 3-3.6mm. A local insect, when found it is on older well established ivy growths usually on old walls. They overwinter in their food plant.

Figure 2B. *Monanthis humuli* Fab. 3.4-4mm. The larvae are often seen in summer being black and covered with yellow hairs on their food plant water forget-me-not. Adults overwinter amongst sedges etc.

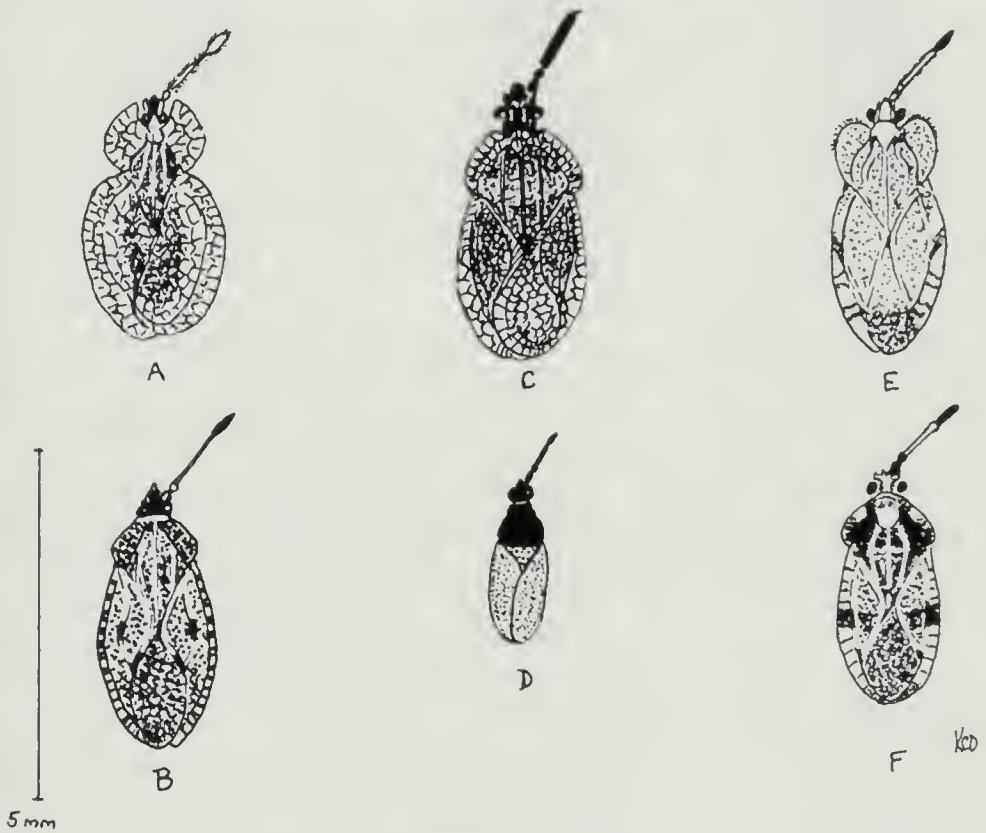

Figure 2C. *Dictyonota strichnocera* Fieb. Gorse Lacebug. 3.5-3.8mm. Adults are found in late summer on gorse and broom. They overwinter as eggs deposited on the young green growths of their food plant. Adults are easily recognised by the enlarged third antennal joint.

Figure 2D. *Agramma laeta* Fln. 2-2.5mm. These minute black and yellow bugs may be swept from rushes and sedges, usually on salt marshes. Because of their small size they are often overlooked in the net. They can be found in most months of the year.

Figure 2E. *Tingis ampliata* H&S. Creeping Thistle Lacebug. 3.5-4mm. This common and numerous species can usually be found on their food plant in summer. Adults hibernate in the undergrowth.

Figure 2 F. *Tingis cardui* L. Spear Thistle Lacebug. 3.-3.3mm, Also found on marsh thistle. Adults hibernate in undergrowth litter.

Lygaeidae Ground or Seed Bugs

Heterogaster urticae Fab.	nettles	27	28
Chilacis typhae Per.	great and lesser reedmace	27	28
Ischnodemus sabuleti Fln.	reeds and var. grasses	27	28
Nysius thymi Wolf	fleabanes, also insectivorous		28
Kleidocerys resedae Panz.	birch catkins and alder	27	28
Kleidocerys truncatulatus Walk.	heathers	27	
Peritrechus geniculatus Hahn	mosses	27	
Pachybrachius fracticollis Schilg.	cotton grass, bog myrtle and sedges	27	
Graptopeltus lynceus Fab.	vipers bugloss		28
Rhaglius alboacuminatus Goeze.	seeds of black horehound, possibly predacious.		28
Megalonotus praetextatus H&S	mosses and var. grasses	27	
Megalonotus chiragra Fab.	.. ..	27	
Trapezonotus arenarius L.	uncertain, possibly predacious	27	
Trapezonotus desertus Seid	.. .. ..	27	
Aphanus rolandri L.	var. plant seeds, possibly predacious		28
Taphropeltus contractus H&S	low ground hugging plants	27	
Acompus rufipes Wolf	seeds of grasses and rushes	27	
Stygnocoris fuligineus Geof.	var. grass	27	28
Stygnocoris pedestris Fln.	ling	27	
Stygnocoris rusticus Fln	chickweeds	27	
Ischnocoris angustulus Boh.	heathers and ling		28
Drymus sylvaticus Fab.	nocturnal feeding on mosses in grass	27	28
Drymus brunneus Sahl.	.. ..	27	28
Scolopostethus pictus Schlg.	small fungi		28
Scolopostethus affinis Schlg.	nettles	27	28
Scolopostethus thomsoni Reut.	nettles	27	

Scolopostethus decoratus Halm.	other insects on heather on heaths	27	
Scolopostethus puberalis Horv.	mosses on marshy ground	27	
Eremocoris fenestralis H&S	juniper		28
Gastrodes grossipes DeG.	Scots pine cones	27	28

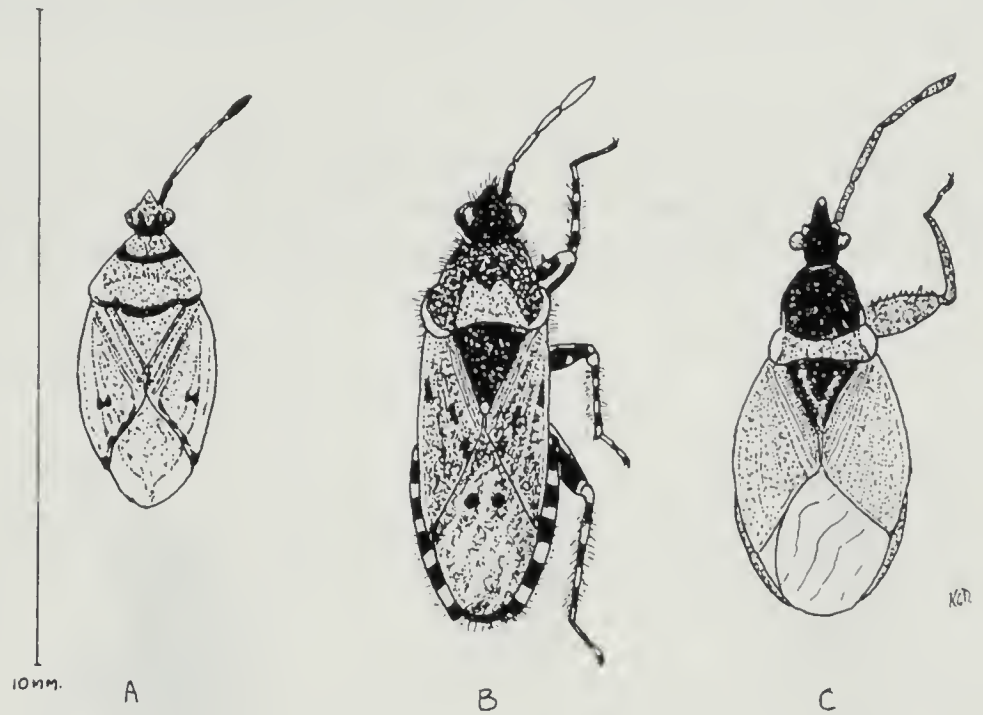

Figure 3A. *Kleidocerys resedae* Panz. 4.5-5.5mm. This brown coloured bug with pink forewings is often found on birch catkins. The adults hibernate beneath bark. They disperse in late autumn. I find many of them on my windows in September.

Figure 3B. *Heterogaster urticae* Fab. Nettle Ground Bug. 6-7mm. This black botched grey insect is common on its food plant during summer. Adults hibernate in litter.

Figure 3C. *Gastrodes grossipes* De Geer. Pine-cone Bug. 5.9-6.6mm. This reddish-brown and black insect is found wherever Scots pine are numerous. Note curious front femur.

Figure 4A. *Ischnodemus sabuleti* Fln. European Clinchbug. 3.9-4.9mm. This pale brown and black bug was classed as a rarity in 1920, but swept northwards from the south coast and was found in Norfolk at Wheatfen, in 1954. It can be found swarming on marsh plants in summer e.g reeds, sweet-grass and even marram grass. The red coloured larvae and adults hibernate in foliage or leaf litter, to which they instantly drop when disturbed.

Figure 4B. *Chilacis typhae* Per. Reedmace Bug. 3.7-4.8mm. This flattish brown bug is more often found by investigating the seed heads of the great and lesser reedmace. Large numbers are sometimes found in one seed head.

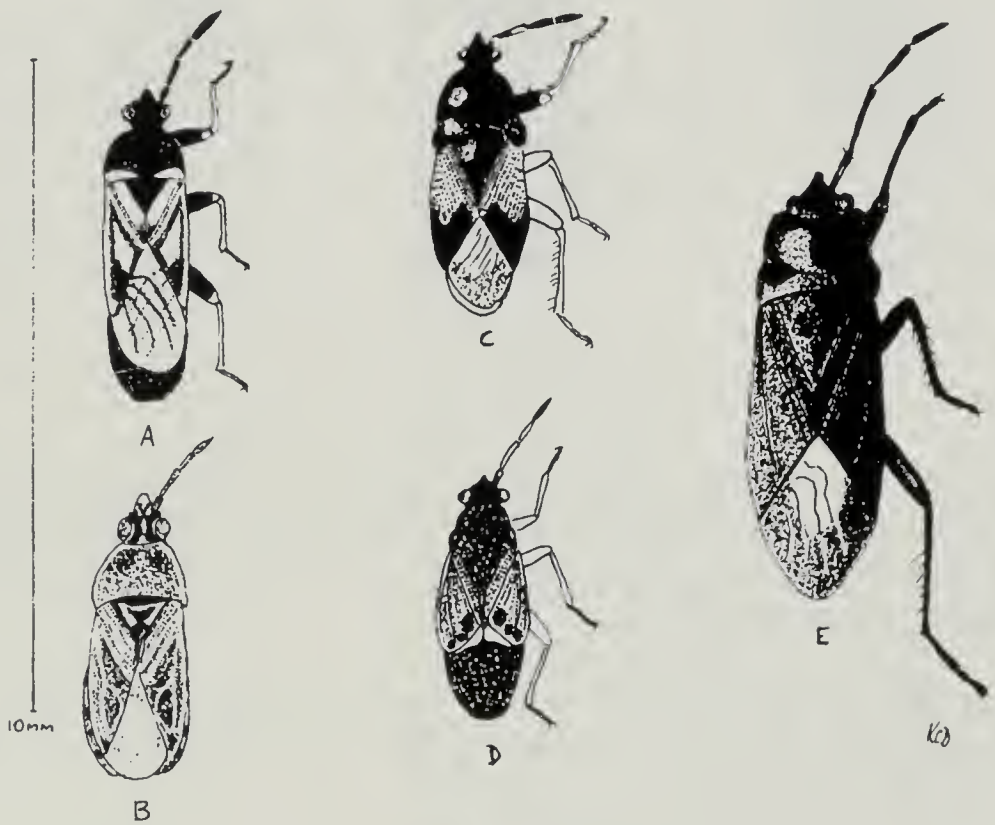

Figure 4C. *Megalontus praetextalis* H&S. 4.1-4.8mm. Usually found under storksbill on coastal dunes.

Figure 4D. *Acompus rufipes* Wolf. 3.5-4mm. Marsh valerian seems to be the host plant most favoured by this bug on which the larval form is found. The adults are more often seen running about on the mud in a similar manner to that of the water bug species *Saldula*. Adults and larvae hibernate in plant litter.

Figure 4E. *Aphanus rolandri* L. 5.5-7mm.This jet black bug was confined to the southern half of the country but has now been found by Mr I.Henderson in his Thetford garden on 6th August 2002; the first Norfolk record of another insect moving northwards recently. This specimen is housed in the Castle Museum collection in Norwich. It is nocturnal and feeds upon fallen plant seeds. Note that the red or orange patch shows through at the bases of the wing membrane.

The **Cimicidae** (Flower Bugs and Bloodsuckers) include a number of bugs which are plant feeders, although many feed on mites and aphids as well. Some are parasitic and feed on the blood of birds, mammals and even humans.

Figure 5A. *Anthocoris nemorum* L. Common Flower Bug. 3.4-4mm. This very abundant shining black and white bug is found on many trees and herbage where it feeds generally on aphids and mites. It will bite humans if handled or if it accidently drops onto bare arms. It can often be found hunting on bark with its rostrum extended as shown.

Figure 5B. *Anthocoris visci* Doug. Mistletoe Flower Bug. 2.6-3.2mm. A small duller species, the head and pronotum being reddish-brown. It feeds upon the larvae of other insects on its host plant.

Figure 5C. *Cimex lectularius* L. Bed Bug. 4-5mm. This chestnut brown bug is not as common today as it was 50 years ago. It has many local names amongst which "Mahogany flats" suitably describes it. Being nocturnal it feeds upon human blood but modern buildings and hygiene together with

insecticides have considerably reduced its numbers. They are always micropterous.

Figure 5D. *Oeciacus birundinis* Jenyn. Martin Bug. 3-3.5mm. A small hairy edition of the bed bug. All stages can be found in the nests of house martins. During the late summer they can sometimes be found in the windows of houses after the martins have migrated.

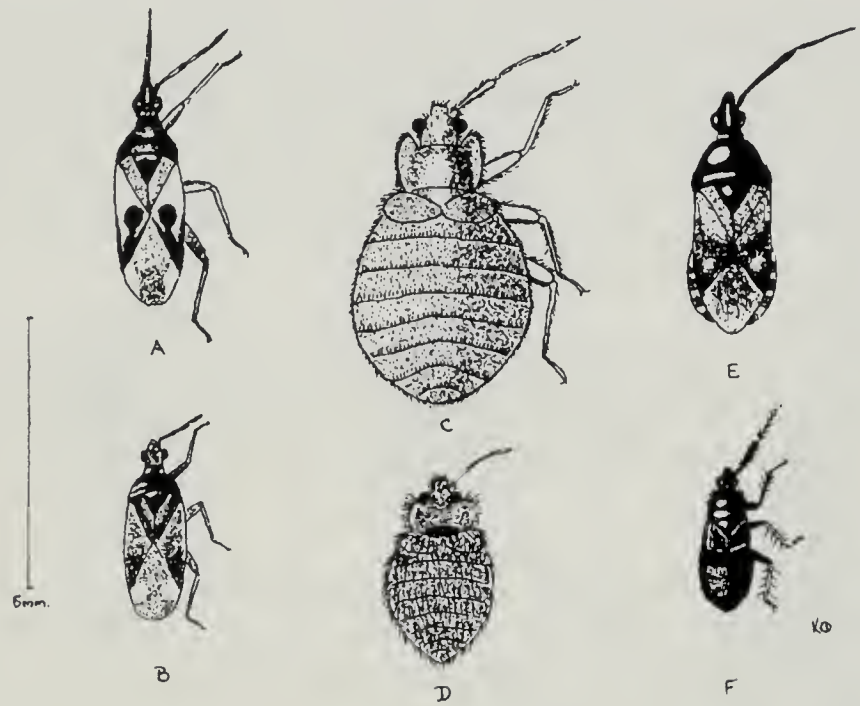

Figure 5E. *Lyctocoris campestris* Fln. Debris or Litter Bug. 3.5-4.5mm. This bug has a black head and pronotum with fawn wings marked with reddish-brown. It used to be very common in hay and straw stacks, but since silage has replaced these habitats it is still to be found in leaf litter under hedges, etc. They frequently bite humans working in gardens to produce small red marks on the skin. There is little lasting irritation.

Figure 5F. *Xylocoris cursitans* Fln. 2-2.5mm. This bristly minute bug is usually found under bark of logs that show signs of decay where it lives on mites and collembola. They are usually brachypterous but macroptera are not uncommon.

Cimiicidae Flower Bugs and Blood Suckers			
Termostethus pusillus H&S	bark lice on lichen covered trees	27	
Anthocoris species are predators of insects			
Anthocoris confusus Reut.	deciduous trees, especially oak	27	
Anthocoris limabtus Fieb.	sallows and willows		28
Anthocoris nemorum L.	.. .. ..	27	28
Anthocoris nemoralis Fab.	var. trees and herbage	27	
Anthocoris visci Doug.	mistletoe	27	28
Anthocoris sarothamni D&S	broom seeds, etc	27	
Acompocoris pygmaeus Fln.	aphids and bark lice on Scots pine		28
Orius minutus L.	great predators of red spider mites	27	
Orius niger Wolf.	mites, thrips and aphids of mugwort	27	
Lyctoris campestris Fab.	predatory on insects, mammal blood	27	
Xylocoris cursitans Fln.	predatory on inverts under bark	27	
Cardiastethus fasciiventris Garb.	aphids on gorse and var. trees	28	
Tetraphleps bicuspis H&S	thrips etc on larch	27	
Cimex lectularius L.	human and mammal blood	27	28
Oeciacus hirundinis Jenyn.	blood of house martins	27	28
Microphysidae Minute Bugs			
Loricula pselaphformis Curt.	mites on lichens on var. trees	27	
Loricula elegantula Baerg.	mites on tree trunks or old stone walls	27	
Myrmedobis distinguenda Reut	mites etc on lichen covered conifers especially where branches touch the ground	27	

Acknowledgements
My thanks to Dr A.G.Irwin for his assistance and co-operation in access to the various collections in the Castle Museum, Norwich.

Miscellaneous observations

Sub-fossil shells of the **river nerite *Theodoxus fluviatilis* (L.)** are abundant in peat deposits of the mid-Yare river valley. These date from the first half of the 20th C. before the post-war pollution levels dramatically reduced water quality and resulted in the loss of the species in the area. The recent improvements in water quality in the mid-Yare and associated broads has seen recolonisation both of aquatic plants and molluscs. In June 2003 large numbers of the river nerite were discovered feeding inside old mussel shells in the Short Dyke leading into Rockland Broad.

Derek Howlett & Roy Baker

ORTHOPTERA REPORT 2002

David Richmond,
42 Richmond Rise, Reepham, Norfolk, NR10 4LS

Grasshoppers and allied insects of Norfolk (Richmond 2001) described the status of the county's orthoptera at the end of the 20th century. This report gives details of subsequent observations with particular reference to the spread of Roesel's bush-cricket in the south-west of the county. Four figure grid references are given for significant new tetrad records. All unattributed records relate to 2002 observations by the author.

Great green bush-cricket *Tettigonia viridissima* was confirmed as still present on waste ground on the Norfolk side of the county border on the A1088 at Thetford. The site also holds a large colony of short-winged conehead.

Roesel's bush-cricket *Metrioptera roeselii* was reported from nine new tetrads as listed below. These extend the known Breckland range to a total of six 10km squares (TF70, TL79, 88, 89, 98, 99). The most northerly record was at Hilborough TF7900 (K Rylands 2000) and the most easterly at West Harling TL9883 and Larling TL9889 (J Poland 2001). The insect was found in dry grassland at East Wretham TL9187, 9188 and Roudham TL9387; and in cleared forestry at Cranwich TL7694, Mundford TL8192 and Hockham TL9392.

Short-winged conehead *Conocephalus dorsalis* was discovered on urban wasteland at King's Lynn TF6217, 6218; the east and west banks of the Great Ouse at Wiggenhall St Mary Magdalen TF6011 and TF5911 (a new 10km square) and in wet meadows and fen at Shouldham Warren TF6610, Castle Acre TF8114 and Kenninghall TM0487. In the brecks it was found beside pingos at Thompson Common TL9396 and on dry grassland at Cranberry Rough TL9293, East Wretham TL9187 and Thetford TL8980.

Common groundhopper *Tetrix undulata* was found in a new 10km square at Cranworth TF9805.

Stripe-winged grasshopper *Stenobothrus lineatus* - the 2001 orthoptera report (*Trans N&NNS* vol **35** part 1) described the discovery of a colony of stripe-winged grasshopper in a disused chalk pit at North Creake, the first record from the north-west of the county for over 80 years. None were heard in the pit in 2002, possibly because of excessive rabbit grazing, but it was heard on nearby set-aside land at TF8737.

Lesser marsh grasshopper *Chorthippus albomarginatus* was found in a new 10km square at Coxford Heath TF8330.

Mottled grasshopper *Myrmeleotettix maculatus* was found in the heathland reclamation area at West Harling TL9783 and 9883. This represents an eastward extension of the known breckland range.

Late dates: The author monitored local populations on an almost daily basis throughout November 2002 to secure the following last records of the year:

Field grasshopper *Chorthippus brunneus* present at Thorpe St Andrew until 14th November,

Speckled bush-cricket *Leptophyes punctatissima* present at Reepham until 21st November,

Dark bush-cricket *Pholidoptera griseoaptera* present at Reepham until 29th November, the latest ever date for an orthopteran in Norfolk.

Reference:

RICHMOND, D., 2001 Grasshoppers and allied insects of Norfolk, *N&NNS occasional publication no 7 (May).*

COLEOPTERA OF HOLKHAM NATIONAL NATURE RESERVE, NORFOLK: ADDITIONS AND CORRECTIONS 2

Bryan Sage

Waveney House, Waveney Close, Wells-next-the-Sea, Norfolk NR23 1HU

Introduction

Seven years have elapsed since the publication of the first paper on the coleoptera of this coastal reserve (Sage 1996), and five years since the first additions and corrections (Sage 2001). At that point the total number of species recorded was 608 in 51 families.

Further work has revealed the presence of a substantial number of additional species. Many of these were found during the course of a field meeting of coleopterists in North Norfolk from 5th-7th July 2002, ten of whom visited Burnham Overy and/or Holkham.

Revised Identifications

The records of *Phaedon concinnus* (Chrysomelidae) from the Burnham Overy marshes on 9th April 1977 and 9th April 1992, are both referable to *P.cochleariae*. The record of *Cyphon variabilis* (Scirtidae) from Holkham pastures on 25th May 1990 is now referred to *C. palustris*. The specimen of *Limnoxenus niger* (Hydrophilidae) taken in a pool near Meals House, Holkham, on 13th August 1993 has proved to be an unusually large and oddly coloured example of *Hydrobius fuscipes*. The record of *Aphthona atrovirens* (Chrysomelidae) from the East Hills, Wells, on 26th April 1994 is now referred to *A.euphorbiae*.

Additions

A further 98 species can now be added to the Holkham National Nature Reserve list and these are detailed in Appendix 1. Taking account of these additions, and the changes discussed above, the list is now increased from 608 to 703 species. With the addition of the Byrrhidae and Melandryidae,

the number of families represented in the Holkham beetle fauna is increased from 51 to 53. In the case of the Carabidae the number of species is increased from 87 to,93, and in the Staphylinidae from 130 to 162. Two other families showing substantial increases are the Chrysomelidae from 37 to 48, and the Curculionidae from 56 to 69.

Habitats

Where the necessary data are available a number of the additional species can be assigned to habitat-types. In the case of those species obtained by general sweeping this is not usually possible. On this occasion there are no additional species to the list for the bare mud habitat.

Saltmarshes

The Chrysomelid *Phaedon concinnus*, for which there is a recent record, is the only addition for this specialised habitat.

Sand Dunes

Seven further species characteristic of sand dunes or dry sandy soils can be added to the list for this habitat – *Amara bifrons* (usually on sand with sparse vegetation), *Bradycellus harpalinus*, *Harpalus attenuatus* (usually in coastal sand dunes), *Barypeithes pellucidus* (found on open sandy, grassy biotopes), *Otiorhynchus atroapterus* (found almost exclusively in coastal sand dunes), *O. raucus* (a ground-living weevil of sandy places), and *Scymnus frontalis* (usually in dry habitats, particularly coastal dunes).

Shores

Four further species (all staphylinids) are added to the list for this habitat – *Aleochara obscurella*, *A. punctatella*, *Halobrecta flavipes* and *Phytosus spinifer*. It may be noted that *A. obscurella*, found at Burnham Overy, is listed by Hammond (2000) as normally being found in tidal debris on rocky shores.

Dykes and Pools

There is just one addition here, the dytiscid *Rhantus frontalis*.

Species Associated With Dyke Flora

The only addition here is the jumping beetle *Scirtes hemisphaericus* which is a frequent and widespread species of wet habitats. It may be found on rushes and other aquatic plants.

Trees and Shrubs

A weevil, *Coeliodenus rubicundus*, found on wild privet *Ligustrum vulgare* is normally associated with birch *Betula* sp. An example of the longhorn beetle *Anoplodera livida* was swept from umbellifers but, as with most of this family, the larval stage is passed within wood. Whilst not an addition to the list, particular interest attaches to the longhorn *Arhopalus rusticus*, a Scottish pine forest species that has steadily spread southwards in conifer plantations in Britain. One was found in a dead pine at Holkham Meals by H.Henson on 3rd August 1956 but it was not recorded again until July 2002.

Non-saltmarsh or Dyke Plants

Some 16 species of herbs have provided records of 19 species of beetle all of which are known to occur on the plants in question:

Plants	Beetles
Asparagus officinalis	*Crioceris asparagi*
Brassica sp.	*Phyllotreta undulata*
	Psyllioides chrysocephala
Brassicaceae	*Ceutorhynchus sulcicollis*
Cirsium sp.	*Sphaeroderma rubidium*
	Sphaeroderma testaceum
Echium vulgare	*Meligethes planiusculus*
Linaria vulgaris	*Rhinusa antirrhini*
Malva sp	*Asidapion aeneum*
	Podagrica fuscicornis
Matricaria discoidea	*Microplontus rugulosus*[a]
Polygonum sp.	*Chaetocnema concinna*
Rumex acetosella	*Apion rubens*
Rumex acetosa	*Perapion violaceum*
Senecio jacobaea	*Longitarsus suturellus*
Sisymbrium officinale	*Ceutorhynchus chalybeus*
Trifolium sp.	*Protapion nigritarse*
Trifolium repens	*Meligethes nigrescens*[b]
Urtica dioica	*Nedyus quadrimaculatus*

(a) This weevil is found on several species of Compositae-Anthemideae.

(b) This pollen beetle is not associated with sea lavenders *Limonium* spp. As stated incorrectly in Sage (1996).

It may be noted that a specimen of the weevil *Ceutorhynchus picitarsis* swept from viper's-bugloss *Echium vulgare* on the sea wall at Wells-next-the-Sea is normally a pest of oil-seed rape *Brassica napus*. This weevil has become much commoner in recent years and is extending its range in East Anglia and the East Midlands.

Fungi

There are four additions in this category – *Anisotoma humeralis* (on fungal growth under the bark of a dead pine tree), *Dimetrota marcida*, *Hallomenus binotatus,* and *Proteinus brachypterus*.

Dung

There are four additions to this group – *Aphodius granarius*, *Cercyon lateralis*, *Cercyon terminatus*, and *Liogluta longiuscula.*

Discussion

With the publication of Sage (1996) the number of species qualifying for Nationally Notable B status was 54. This figure is now increased to 59 with the addition of *Antherophagus canescens, Hallomenus binotatus, Neliocarus faber, Podagrica fuscicornis* and *Rhantus frontalis*. The number of Nationally Notable A species increases from two to three with the addition of *Ocypus opthalmicus*. Another of the recent additions, *Cypha pulicaria*, is Nationally Notable.

There are four additions to the county list, the chrysomelid *Phaedon concinnus,* the weevils *Otiorhynchus atroapterus* and *Sitona ambiguous*, and the staphylinid *Dimetrota (=Atheta) marcida.*

Acknowledgements

I am indebted to Martin Collier (MC) who collated the hundreds of records resulting from the July 2002 field meeting and who read this paper in draft, and to the

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Appendix 1

Additions to the beetle list for Holkham National Nature Reserve.

Unattributed records (by initials) are those of the author. Notes refer to the status of the species in Hyman & Parsons (1992 & 1994). Nomenclature basically follows Kloet & Hincks (1977) but subsequent taxonomic changes have been taken into account. For ease of reference both families and species are listed in alphabetical order.

Anobiidae

Hemicelus fulvicornis (Sturm) – Holkham, 5-7th July 2002 (MS). Usually found in dead hedges etc.

Anthicidae

Anthicus antherinus (L.) – Burnham Overy , 7th July 2002 (KC).

Apionidae

Apion rubens Stephens – East Hills, Wells, 26th June 2002, on sheep's sorrel *Rumex acetosella.*

Asidapion aeneum (Fabricius) – Burnham Overy, 5th July 2002 (CW), on *Malva* sp.Holkham. 5th-7th July 2002 (MS).

Ceratapion onopordi (Kirby) – Burnham Overy, 26th June 2001, swept from Compositae in grassland.

Perapion violaceum (Kirby) – Holkham, 5th-7th July 2002 (MS), on *Rumex* sp.

Protapion nigritarse (Kirby) – Holkham Meals, 19th May 2001, on *Trifolium* sp.

Byrrhidae

Simplocaria semistriata (Fabricius) – Holkham Gap area, 3rd June 2000 (MGT).

Byturidae

Byturus tomentosus (Degeer) – Burnham Overy, 7th July 2002 (KC).

Cantharidae

Malthinus sereipunctatus Kiesenwetter – Burnham Overy, 5th july 2002 (CW).

Carabidae

Amara bifrons (Gyllenhal) – Burnham Overy, 6th July 2002 (PMP). Usually on sand with sparse vegetation.

Amara plebeja (Gyllenhal) – Burnham Overy, 6th July 2002 (BL).

Bradycellus harpalinus (Audinet-Serville) – Holkham Gap area, 7th July 2002 (ML), by sieving moss and litter.

Harpalus attenuatus Stephens – East Hills, Wells, 26th June 2002, at base of dunes.

Notiophilus rufipes Curtis – Holkham Gap area, 7th July 2002 (ML), by sieving moss and litter.

Syntomus (*Metabletus*) *truncatellus* (L.) – Burnham Overy, 5th July 2002 (CW), by sieving moss at roots of marram *Ammophila arenaria* behind dune ridge.

Cerambycidae

Anoplodera livida (Fabricius) – Bone's Drove, Holkham, 9th July 2001, swept from umbellifers.

Chrysomelidae

Chaetocnema concinna (Marsham) – Bone's Drove, Holkham, 19th July 2002, swept from *Polygonum* sp. in grazing pasture.

Crioceris asparagi (L.) – Burnham Overy, 6th July 2002 (BL), on asparagus.

Galeruca tanaceti (L.) – Bone's Drove, Holkham, 19th July 2002, by sweeping in grazing pasture.

Gastrophysa polygoni (L.) – Holkham Bay, 1st May 2002 (JRW), in sand dunes.

Lema cyanella (L.) – Holkham Gap area, 3rd June 2000 (MGT).
Longitarsus suturellus (Duftschmid) – Holkham , 19th May 2001, on ragwort *Senecio jacobaea.*
Phaedon concinna (Marsham) – Holkham , 5th-7th July 2002 (MS), by sweeping near edge of developing saltmarsh. **Nat.Not.B.**
Phyllotreta undulata Kutschera – Burnham Overy, 6th July 2002 (RB), on Cruciferae.
Podagrica fuscicornis (L.) – Burnham Overy, 5th July 2002 (CW, RB, ISM, MS), on *Malva* sp. Holkham, 5th –7th July 2002 (MS). **Nat.Not.B.**
Psylliodes chrysocephala ((L.) – Burnham Overy, 6th July 2002 (RB), on *Brassica* sp.
Sphaeroderma rubidium (Graells) – Burnham Overy, 5th July 2002 (CW), on *Cirsium* sp.

Coccinellidae

Psyllobora 22-punctata (L.) – Burnham Overy, 14th July 2002 (ABO).
Scymnus frontalis (Fabricius) – Holkham, 5th-7th July 2002 (MS). A characteristic species of dry habitats, particularly coastal dunes.

Cryptophagidae

Antherophagus canescens Grouvelle – Burnham Overy, 5th July 2002 (BL, CW), by sweeping thrift *Armeria maritima,* and 6th July 2002 (BL) by sweeping. **Nat.Not.B.**
Atomaria rubella Heer – Burnham Overy, 6th July 2002 (RB), by sieving tidal debris.
Atomaria testacea Stephens – Burnham Overy, 7th July 2002 (KC).

Curculionidae

Barypeithes pellucidus (Boheman) – Holkham Bay, 2nd May 2001, in sand dunes at edge of conifers.
Ceutorhynchus chalybeus (=timidus) Germar – Burnham Overy, 6th July 2002 (RB), on hedge mustard *Sisymbrium officinale.*
Ceutorhynchus picitarsis Gyllenhal – Wells, 17th June 2002, swept from Viper's bugloss *Echium vulgare* on sea wall. Normally found on oil-seed rape *Brassica napus.*
Ceutorhynchus sulcicollis (Paykull) – Burnham Overy, 6th July 2002 (RB), on Brassicacaea.
Coeliodinus rubicundus (Herbst.) – Burnham Overy, 5th July 2002 (CW), on flowers of wild privet *Ligustrum vulgare*, but is normally associated with birch *Betula* sp.
Microplontus rugulosus (Herbst.) – Bone's Drove, Holkham, 19th July 2002, on pineapple weed *Matricaria discoidea.*

Nedyus (Cidnorhinus) quadrimaculatus (L.) –Wells, 17th June 2002, on common nettle *Urtica dioica.*

Neliocarus (Strophosoma) faber (Herbst.) – Burnham Overy, 17th July 2001 (Denton 2000), under plantain *Plantago* sp. **Nat.Not.B.**

Otiorhynchus atroapterus (Degeer) – Burnham Overy, 5th July 2002 (CW), at base of dunes.

Otiorhynchus raucus (Fabricius) – Burnham Overy, 17th July 2001 (Denton 2000), under plantain *Plantago* sp.

Rhinusa (Gymnetron) antirrhini (Paykull) – Warham saltmarsh, 23rd July 2001, on common toadflax *Linnaria vulgaris* in marginal grassland.

Sitona ambiguus Gyllenhal – Holkham, 5th-7th July 2002 (MS).

Sitona cylindricollis (Fahraeus) – Burnham Overy, 4th August 1991, in sand dunes.

Dytiscidae

Rhantus frontalis (Marsham) – Near Meals House, Holkham, 12th October 2001, in brackish pool in pasture **Nat.Not.B.**

Elateridae

Kibunea minuta (L.) – Burnham Overy, 6th July 2002 (RB), by sweeping along sea wall.

Melanotus villosus (Fourcroy) – Holkham, 6th July 2002 (MGT).

Histeridae

Kissister minimus (Aubé) - Burnham Overy 15 th February 1998 (MC)

Hydrophilidae

Cercyon analis (Paykull) – Burnham Overy, 6th July 2002 (RB), by sieving tidal debris.

Cercyon lateralis (Marsham) – Bone's Drove, Holkham, 19th July 2002, in cow dung in pasture.

Cercyon terminatus (Marsham) – Burnham Overy, 5th July 2002 (CW), in human faeces in sand dunes.

Leiodidae

Anisotoma humeralis (Fabricius) – Near Bone's Drove, Holkham, 30th September 2001, in fungal growth under bark of dead pine tree.

Melandryidae

Hallomenus binotatus (Quensel) – Holkham, 7th July 2002 (ML), in fungus on stump. **Nat.Not.B.**

Melyridae

Malachius bipustulatus (L.) – Holkham, 5th-7th July 2002 (MS), by sweeping.

Psilothrix viridicoeruleus (Fourcroy) – Burnham Overy, 5th July 2002 (CW), swept from saltmarsh below sea wall.

Nitidulidae

Meligethes nigrescens Stephens – Burnham Overy, 5th July 2002 (CW), on white clover *Trifolium repens*.

Meligethes planiusculus (Heer) – Wells, 17th June 2002, on viper's-bugloss *Echium vulgare* on sea wall.

Phalacridae

Olibrus liquidus Erichson – Holkham, 5th-7th July 2002 (MS).

Ptilidae

Acrotrichis sitkaensis (Motschulsky) – Burnham Overy, 6th July 2002 (RB), by sieving tidal debris.

Ptenidium fuscicorne Erichson – Burnham Overy, 6th July 2002 (RB), by sieving tidal debris.

Scarabaeidae

Aphodius granarius (L.) – Holkham Gap area, 3rd June 2000 (MGT), in dung.

Scirtidae

Cyphon hilaris Nyholm – Burnham Overy, 5th July 2002 (CW), swept from saltmarsh below sea wall.

Scirtes hemisphaericus (L.) – Near Bone's Drove, Holkham, 19th July 2002, swept from dyke vegetation.

Staphylinidae

Aleochara bipustulata (L.) – Holkham, 23rd October 1995 (RB), in dunes.

Aleochara obscurella Gravenhorst (=*A.algarum*) – Burnham Overy, 5th July 2002 (CW), by sieving seaweed on beach.

Aleochara punctatella Motschulsky – Burnham Overy, 5th July 2002 (CW), by sieving seaweed and in dead cormorant on beach.

Amischa forcipata Mulsant & Rey – Burnham Overy, 5th July 2002 (CW), swept from mallow *Malva* sp. on sea wall.

Acrotona (Atheta) parvula (Mannerheim) – Burnham Overy, 5th July 2002 (CW), in human faeces in dunes.

Anotylus complanatus (Erichson) – Burnham Overy, 5th July 2002 (CW), in human faeces in dunes.

Anthobium unicolor (Marsham) – Holkham, 23rd October 1995 (RB), in dunes.

Callicerus obscurus Gravenhorst – Warham Greens, 23rd February 2003, swept from rough grassland.

Carpelimus corticinus (Gravenhorst) – Holkham Bay, 1st May 2002 (JRW), on saltmarsh area.

Cypha pulicaria (Erichson) – Burnham Overy, 6th July 2002 (RB), by sweeping on sea wall. **Nat.Not.**

Dimetrota (Atheta) marcida (Erichson) – Holkham, 23rd October 1995 (RB), in fungi in dunes.
Halobrecta flavipes Thomson – Burnham Overy, 6th July 2002 (BL), at edge of saltmarsh.
Liogluta longiuscula (Gravenhorst) – Holkham, 23rd October 1995 (RB), in dung in the dunes.
Mycetporus lepidus (Gravenhorst) – Holkham Gap area, 7th July 2002 (ML), by sieving moss and litter.
Mycetoporus longulus Mannerheim – Burnham Overy, 6th July 2002 (RB).
Mycetoprus nigricollis Stephens - Burnham Overy 15th 1998 (MC)
Nehemitropia lividipennis (Mannerheim) – Burnham Overy, 6th July 2002 (CW), in human faeces in dunes and by sweeping.
Ocypus brunnipes (Fabricius) – Holkham Gap area, 7th July 2002 (ML), on ground in pine woods.
Ocypus opthalmicus (Scopoli) – Burnham Overy, 6th July 2002 (RB), running over sand. **Nat.Not.** *A.*
Othius subuliformis Stephens (=*O.myrmecophilus*) – Holkham Gap area, 7th July 2002 (ML), by sieving moss and litter.
Philhygra (*Atheta*) *palustris* (Keisenwetter) – Burnham Overy, 5th July 2002 (CW), by sweeping mallow *Malva* sp. on sea wall, by sweeping saltmarsh below sea wall, and in human faeces in dunes.
Phytosus spinifer Curtis – Burnham Overy, 5th July 2002 (CW), by sieving seaweed on beach.
Proteinus brachypterus (Fabricius) – Holkham, 23rd October 1995 (RB)
Quedius (Raphirus) boops (Gravenhorst) – Burnham Overy, 5th July 2002 (CW), by sieving moss at roots of marram *Ammophila arenaria.*
Quedius cinctus (Paykull) - Burnham Overy 15 th 1998 (MC)
Quedius levicollis (Brulle) (=*Q.tristis*) – Burnham Overy, 6th July 2002 (BL,RB), in dunes.
Quedius semiaeneus (Stephens) - Burnham Overy, 15th February 1998 (MC).
Rugilus rufipes Germar – Burnham Overy, 7th July 2002 (EP).
Stenus aceris Stephens – Burnham Overy, 6th July 2002 (RB), by sweeping in dunes.
Stenus impressus Germar – Burnham Overy, 5th July 2002 (CW), by sieving moss at roots of marram *Ammophila arenaria.*
Tachyporus dispar (Paykull) – Burnham Overy, 5th July 2002 (CW), by sieving moss as above.

Tinotus morion (Gravenhorst) – Burnham Overy, 5th July 2002 (CW), in human faeces in dunes.
Xantholinus (Purrolinus) elegans (Olivier) (=*X.jarrigei*) – Holkham Gap area, 7th July 2002 (ML), by sieving moss and litter.

RECENT BRYOPHYTE RECORDS (2000-2002), INCLUDING FOUR NEW TO NORFOLK

J B Mott
62 Great Melton Road, Hethersett, Norwich, NR9 3HA
&
C R Stevenson
111 Wootton Road, King's Lynn, PE30 4DJ

During the last two years there has been continued intensive bryophyte recording in the County, with the result that there have been four new records for Norfolk, all from VC27, and numerous new 10 km square finds. The latter are only presented for those species which, in the Flora, were regarded as rare or very rare, i.e. which occurred in fewer than 6 squares. There have also been three re-finds of species which have not been seen since 1950 or earlier. These too all came from VC27. The number at the end of each entry is the total number of 10 km squares in which the species occurs.

Liverworts

Calypogeia arguta, sandy bank by side of ditch/stream, Pigney's Wood, North Walsham, VC27, TG23, 2001, CRS. Refound for Norfolk and VC27. 1.

Cephaloziella hampeana, Beeston Common, VC27, TG14, 2002. JBM, conf. CRS. 6.

Fossombronia pusilla, on vertical edge of an old wheel track through a conifer wood, Swannington Bottom Plantation, Felthorpe, VC27, TG11, 2001, LH. 4.

Fossombronia wondraczekii, on vertical edge of an old wheel track through a conifer wood, Swannington Bottom Plantation, Felthorpe, VC27, TG11, 2001, LH. 2.

Kurzia pauciflora, in among *Sphagnum* sp., Buxton Heath, VC27, TG12, 2000. 3.

Leiocolea badensis, Wells Chalk Pit, VC28, TF94, 2002. 3.

Marchantia polymorpha ssp. *polymorpha*, Bawburgh Lakes Fishery, VC27, TG10, 2000. 1.

Marchantia polymorpha ssp. *ruderalis*, Wells Chalk Pit, VC28, TF94, 2002, East Wretham Heath, VC28, TL98, 2002, Blakeney Fresh Marsh, VC27, TG04, 2001, Smallburgh Fen, VC27, TG32, 2000. 6.

(The above two species had previously been recorded as *Marchantia polymorpha agg.*)

Pellia neesiana, Felthorpe Lakes, VC27, TG11, 2001, LH. Only third record for Norfolk. 3.

Sphaerocarpos michelii, Hickling Broad, VC27, TG42, 2002. 6.

Mosses

Amblystegium humile, Strumpshaw Fen, RSPB Reserve, VC27, TG30, 2002, NGH. 3.

Cinclidotus fontinaloides, Strumpshaw Common, VC27, TG30, 2002, NGH. This is now the third find on the River Yare. 2.

Didymodon umbrosus, in quantity on mortar between flints on buttress on N side of St George's Church, Colegate, Norwich, VC27, TG20, 2001, CRS. Bloom's, Bressingham, VC27, TM08, CRS. 2002. 3.

Ephemerum recurvifolium, King's Lynn, VC28, TF62, 2001, CRS. 4.

Eurhynchium crassinervum, on an old rockery originally built from Welsh limestone pavement, Earlham Park, Norwich, VC27, TG10, 2001, RJF & JBM. New for Norfolk & VC27. 1.

Gyroweisia tenuis, on old brick wall in shade, Plantation Garden, Norwich, VC27, TG20, 2001, JG. 5.

Herzogiella seligeri, Swannington Upgate Common, VC27, TG11, 2002. 4.

Hygrohypnum luridum, on oolitic limestone coping stones on wall in shade, Plantation Garden, Norwich, VC27, TG20, 2001, JG. 6.

Hypnum andoi, Coldham Hall, Surlingham Broad, VC27, TG30, 2002, NGH, Honing Common, VC27, TG32, 2001. 4.

Leptodontium flexifolium, on thatch roof of a boat house, Horsey Mere, VC27, TG42, 2002, MG. New VCR. 2.

Microbryum curvicolle, in short chalk grassland, Weeting Heath, VC28, TL78, 2001. 4.

Microbryum starkeanum, on silty soil on roadside bank, Blakeney village, VC27, TG04, 2001, CRS. 6.

Mnium stellare, on an old rockery originally built from Welsh limestone pavement, Earlham Hall, Norwich, VC27, TG10, 2001, RJF & JBM. New for Norfolk and VC27. 1.

Orthotrichum stramineum, Reedham Marsh, VC27, TG31, 2002, JBM. Only second record for Norfolk. 2.

Palustriella commutata var. *falcata*, Smallburgh Fen, VC27, TG32, 2000. New for Norfolk and VC27. 1.

Philonotis fontana, Holt Lowes, VC27, TG03, 2000. 5.

Plagiomnium cuspidatum, Rush Meadow, East Dereham, VC28, TF91, 2002, CRS. 5.

Plagiothecium ruthei, Mid Yare Valley RSPB Reserve, VC27, TG30, 2002, NGH. Refound for VC27. 1.

Racomitrium canescens, Weeting Heath, VC28, TL78, 2001. 3.

Rhynchostegium megapolitanum, Felthorpe, VC27, TG11, 2002, LH. 3.

Pylaisia polyantha, Mid Yare Valley RSPB Reserve, VC27, TG30, 2002, NGH. New for Norfolk. New for VC27. 1.

Saniona uncinata, Marston Marsh, TG220055, 13/8/02, CRS, refound for VC27. 1.

Scleropodium cespitans, Mid Yare Valley RSPB Reserve, VC27, TG30, 2002, NGH. New for Norfolk. New for VC27. 1.

Seligeria calycina, Wells Chalk Pit, VC28, TF94, 2002. 6.

Sphagnum inundatum, Hickling Broad, VC27, TG42, 2002. 6.

Tortula acaulon var. *schreberiana*, Felthorpe, VC27, TG11, 2000, LH. 2.

Zygodon viridissimus var. *stirtonii*, Plumstead Church, VC27, TG13, 2002, CRS. 2.

Key
RWE, R W Ellis; RJF, R J Fisk; M G, Mary Ghullam; JG, J Goodwin; LH, L Hall; NGH, N G Hodgetts; WGM, W G Mitchell; JBM, J B Mott; CRS, C R Stevenson. Where no initials are given the discovery was made during a meeting of the Norfolk Bryology Group.

THE LARGE POND-SKATER *AQUARIUS=GERRIS PALUDUM* (Fab. 1794) HETEROPTERA: GERRIDAE IN NORFOLK.

Geoff Nobes
Springside, Carbrooke, Thetford. Norfolk. 1P25 6SQ.

On the 22nd August 2002 a very large pond-skater was seen on one of the natterjack toad *(Bufo calamita)* pools at Winterton Dunes Nature Reserve. On consulting the Freshwater Biological Associations key to the aquatic Hemiptera Heteroptera Savage (1989) it was found to be a male of the Notable N/b *Aquarius = Gerris paludum.* (Fab.). It was 16mm in length, huge when compared to the common *G. thoracicus* (Schummel) at 9mm, and a veritable giant against the diminutive 6mm long *G. argentatus* (Schummel). These two species also occur at Winterton.

The habitat was one of the larger and deeper, slightly acidic pools excavated for the Natterjack toads.The pool is about one metre deep and surrounded by reed *Phragmites australis.,* the *Gerris* was patrolling the middle amongst clear water. Savage (1989) records the main habitat of *Gerris paludum* as lakes and occasionally slow flowing rivers and so the site at Winterton would seem to be unusual.

There are two other very large *Gerris* species in Britain and *G. paludum* is separated from these by the sides of the pronotum having a yellow line. It is nearly always winged whereas *G. najas* (DeGeer) is usually wingless.

Limnoporus rufoscutellatus (Latr) has a reddish pronotum that of *G. paludum* and *G. najas* being black.

G. najas has not been reported from Norfolk but Ken Durrant (*pers. comm.*) mentions seeing a specimen of *L. rufoscutellatus* on a small pond at Hoe Common on on 13th March 1948. Durrant (2002), the only Norfolk record. Ken Durrant also reported the occurrence of three specimens of *G. paludum* on the large man-made pond at Beeston Common on 19th September 2002. Durrant (2002).

Why *G paludum* has taken so long to reach Norfolk is a mystery but conceivably they could have been migrants from Europe as they occurred at a time of other significant invertebrate migrant activity.

The addition of *G. paludum* to the Norfolk list in 2002 brings the total of Gerris species occurring in the County to seven and these are listed below.

Gerris lateralis (Schummel).
Gerris thoracicus (Schummel).
Gerris argentatus (Schummel).
Gerris lacustris (Linnaaeus).
Gerris odontogaster (Zetterstedt).
Gerris=Aquarius paludum (Fabricus).
Limnoporus rufoscutellayus (Latreille)

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WILDLIFE 2000

THE SPIDERS OF WHEATFEN BROAD.

D.R. Nellist
198A Park St. Lane, Park St, St Albans, AL2 2AQ

Members of the British Arachnological Society surveyed the spiders of Wheatfen Broad Nature Reserve on two occasions during 2002. In addition, specimens captured using pitfall traps, operated from the 22nd May until the 23rd July, were also identified. One hundred and twenty nine species were recorded and the total number of species on the site check list increased from one hundred and eighteen to one hundred and sixty eight. The list contains two Red Data Book species and seven Nationally Notable species. However, the continuing presence on the site of the two Red Data Book species, *Carorita paludosa* Duffey, 1971 and *Centromerus semiater* (L. Koch, 1879), last recorded at Wheatfen in 1971, and the Nationally Notable *Tetragnatha striata* L. Koch, 1862, last recorded in 1936, was not confirmed during the surveys.

Introduction

Wheatfen Broad, some six kilometres east of Norwich, is a Site of Special Scientific Interest and one of the few remaining areas of the Yare Valley Swamp. It has over 40 hectares of reed swamp, tidal channels, carr, the small broads of Wheatfen and Broadwaters and several kilometres of pathways. For forty years, until his death in 1986, Wheatfen Cottage was the home of Ted Ellis, the well-known writer and broadcaster on natural history topics. The Ted Ellis Trust was formed in 1986 to protect Wheatfen and its rich but fragile ecology and to promote the continuing study of its natural history.

In 2001 the Trust invited the British Arachnological Society (BAS) to survey the spiders of Wheatfen as part of a broader programme to increase the knowledge of the flora and fauna of the site. Responding to the invitation members of the BAS visited the site over the weekends of

24th-26th May and 6th-8th September, 2002. The habitats examined included large reed beds, sallow carr, wet woodland, shrubs and trees and the edges of dykes and paths bordered with herbaceous vegetation. Of particular interest were large heaps of cut reed some of which had been undisturbed for very long periods. At the request of David Nobbs, the Warden, special attention was given to two large reed beds, Four Acre Marsh and Thack Marsh. The former area has not been managed for over 30 years, whilst the latter area was recovered from sallow carr some five years ago and allowed to revert to reed bed. Incidentally, both these areas, and others at Wheatfen carrying the name Marsh, are mis-named; they are in fact true fens. Participants used a variety of collecting methods, such as grubbing, sweep-netting, beating shrubs and the lower branches of trees, as appropriate to the structure of the habitat being examined. In addition David Nobbs volunteered to operate pitfall traps during the summer of 2002 and traps were set and emptied weekly from 22nd May through to 23rd July in Thack Marsh, Four Acre Marsh, Crakes Marsh, Alder Carr Marsh and in herbaceous vegetation adjoining Smee Loke path. Very few of the more than six hundred species on the British list have common names. Scientific names are therefore used exclusively in the text of this paper although the authority is omitted. However, a list of the scientific names of all the species now recorded on Wheatfen Broad, including authorities, is given in table 1 with the nomenclature following the latest check list published by the British Arachnological Society (Merrett & Murphy, 2000).

Records prior to 2002

Before the BAS visits little was known about the spider fauna of the site. Dr A. R. Jackson had identified 82 species in 1936, amongst them being *Hypomma fulvum*, *Donacochara speciosa* and *Tetragnatha striata*, all three now having Nationally Notable Status (Merrett, 1990). A former owner of Wheatfen, M. J. D. Cockle, added ten species to the list during the years 1937-1946 and a few individuals, including Ted Ellis himself, added others. But it was not until 1971 that the list was substantially increased when, during a short visit, a party led by Dr. Eric Duffey added thirty eight species. These included *Carorita paludosa* and *Centromerus semiater*, both now having Red Data Book [RDB2, Vulnerable] status (Bratton, 1991). All

these early records were collated, and the nomenclature updated, by M. E. A. Shardlow (1993) at which time the list of species totalled one hundred and eighteen. These are indicated in table 1, column A. Note that the names used by Shardlow have been changed again, where necessary, to bring the nomenclature into line with the latest British Arachnological Society check list (Merrett & Murphy, 2000).

Results of BAS visits

The check list

During the first visit by BAS members in May 2002, one hundred species were recorded from a variety of habitats, including reed beds, piles of cut reed, herbaceous vegetation, shrubs and trees (see table 1, column B). Of these forty were new additions to the Wheatfen list (indicated by * in the table) including the Nationally Notable species, *Theridiosoma gemmosum* (Nb), *Entelecara omissa* (Na), *Philodromus praedatus* (Nb) and *Philodromus aureolus* (Nb). The continuing presence of *Hypomma fulvum* (Na), first recorded by Jackson in 1936, was also confirmed. During the second visit in September 2002, sixty-two species were recorded (table 1, column C) of which eight were new to the site list taking the overall total to one hundred and sixty six. At the end of the second visit in September the present author was handed a box, recently discovered in Wheatfen Cottage (still the home of Mrs Phyllis Ellis, Ted Ellis' widow). It held 126 small tubes, each containing one or more spiders, plus a hand-written label carrying the date 1937 or 1938. Apparently these had been collected by Dr A. R. Jackson. Inevitably, because the tubes had been corked, the spirit had long since evaporated and the specimens are now dried husks. Nevertheless, it may be possible to re-hydrate and swell these to the point where the female epigynes and male palps are recognisable allowing the specimens to be named. This will be attempted in due course. However, specimens in sixteen of the tubes had been identified, almost certainly by Dr. Jackson, and a species name added to the tube. These eleven species are listed in table 1, column E. One of these, *Tibellus oblongus*, was new to the Wheatfen list and its inclusion in table 1 thus took the current total for Wheatfen to one hundred and sixty seven. It is not possible here to discuss the habitat details of all the one hundred and twenty nine species recorded

onacochara speciosa (Photo Ian Dawson)

rinioides cornutus (Photo Ian Dawson)

Araneus quadratus (Photo Ian Dawson)

Pisaura mirabilis (Photo Ian Dawson)

but, in due course, the data for all the species will be added to the dataset of the National Spider Recording Scheme (Harvey, Nellist and Telfer, 2002). In the notes that follow comments are restricted, in the main, to the rarer Nationally Notable species and those which are new records for the site, gathered under the headings of the major habitats. However it is worth noting here that the five species found most abundantly on the site (in order of abundance as judged by the number of specimens recorded) were *Bathyphantes approximatus Gnathonarium dentatum Rugathodes instabilis Entelecara omissa* and *Hypomma bituberculatum.* All are well-known wetland species and generally widespread throughout Britain except for *Entelecara omissa* which, apart from half a dozen other, widely scattered sites in England is restricted to the fens of Norfolk, Suffolk and Cambridgeshire.

Comparison of Four Acre and Thack Marshes.

The comparison between the spider faunas of Four Acre and Thack Marshes was certainly not done in a tightly-controlled and systematic manner. Participants were simply asked to spend an hour in Four Acre Marsh followed by an hour in Thack Marsh, on the morning of the first day of both weekends, and use a collecting technique they thought appropriate. The species recorded during these periods are shown, for Four Acre Marsh, in table 2, column A, and for Thack Marsh in table 2, column B. In total sixty species were recorded for the two areas although only thirty-two (53%) were common to both. These included *Theridiosoma gemmosum, Entelecara omissa* and *Hypomma fulvum* though these have Nationally Notable status they are not infrequent in the East Anglian fens. However many more specimens of *Entelecara omissa* were recorded on Four Acre Marsh than on Thack Marsh. A number of other species, particularly *Bathyphantes approximatus*, were abundant on both sites. It is interesting that of the species restricted to one or other of the sites the four large orb-web weavers *Araneus diadematus, Araneus quadratus, Araneus marmoreus* and *Araneus triguttatus* were all restricted to Four Acre Marsh. There are apparently no previous records for *Araneus triguttatus* in East Norfolk. By coincidence the total number of species recorded at each site was the same at forty six. The above, admittedly rather limited evidence,

does not suggest that the fauna of Thack Marsh, reclaimed from Alder Carr some five years ago, is seriously depleted relative to that of the unmanaged Four Acre Marsh.

Alder Carr Marsh

Alder Carr Marsh, on the north-west corner of the Wheatfen Broad reserve, was examined during both the May and September visits for it was in this area that *Carorita paludosa* (RDB2, Vulnerable) and *Centromerus semiater* (RDB2, Vulnerable) were recorded during the visit of Dr Eric Duffey's party in 1971. Apart from one site in Somerset *Carorita paludosa* is confined to E. Norfolk being recorded at Reedham Marsh, Hickling Broad, Catfield Fen and Wheatfen. Although it has previously been taken in some numbers at Wheatfen its continuing presence on the site was not confirmed during the BAS visits. However, it is a minute spider, only 1.5mm in length, and thus easily overlooked. Also the September visit may have been just too early in the season for mature specimens to be present. The other RDB species, *Centromerus semiater*, restricted to Wicken Fen and three sites in Norfolk, is another very small spider and not recorded during the visits. Thirty five species were recorded on the Marsh (table 2, column C) including the three Nationally Notable species *Theridiosoma gemmosum* *Entelecara omissa* and *Hypomma fulvum*

Trees and Shrubs bordering Old Mill Marsh

The trees and shrubs along the side of the path running north from the Thatch hide proved to be very productive both for the total number of species recorded and for those new to the site. Beating the gorse, other shrubs and the lower branches of trees produced a list of thirty nine species of which thirteen were new to Wheatfen. Not least was this due to the presence of gorse which is known to provide a particularly favoured habitat for many species. Perhaps the most interesting capture was the Nationally Notable *Philodromus albidus* (Nb). In Britain it is confined to the area south of a line drawn approximately from the Wash to the Severn Estuary and may be frequent in some parts, but there is apparently only a single previous record from E. Norfolk. *Philodromus praedatus* (Nb), a new

record for E. Norfolk, may have been overlooked in the past as separation of females from certain other species in the genus is difficult.

Piles of Cut Reed

Some of the piles of cut reed, found at intervals along the pathways, have apparently been in existence for many years with fresh material being added each year. Thirty six species were recorded with *Diplostyla concolor, Gnathonarium dentatum* and *Pocadicnemis juncea* being the most common in this habitat, whilst *Entelecara erythropus*, *Bathyphantes nigrinus, Clubiona lutescens* and *Micaria pulicaria* were not found in any of the other major habitats.

Tussocks of the Great Tussock Sedge

Several of the distinctive tussocks of the great tussock sedge, *Carex paniculata,* were carefully examined. The substantial base of fibrous rhizomes, and the build-up of litter around the base, provides an abundance of niches for spiders and the concentration of specimens in and immediately around the tussocks seemed to be greater than in the wider area surrounding them. But, in spite of this, only one specimen of one species *Walckenaeria nudipalpis* was found in a tussock (in Alder Carr Marsh) that had not been found elswhere. Twenty three species were recorded in total.

Surlingham Wood

On the eastern, lower side of the wood, fallen leaves, the main component of the ground layer, appeared to have been sorted and settled into a horizontal position and then compacted into a thick mat with few niches available for spiders, presumably the result of the periodic inundation of this area. On the higher and drier ground on the western side specimens were somewhat more abundant. Overall 24 species were recorded from within, or along the edge of the wood of which 5 were new records for Wheatfen - *Diplocephalus picinus* and *Lepthyphantes zimmermanni* - both characteristic woodland litter species, *Linyphia hortensis* in the field layer, *Pardosa saltans* on the ground and *Anyphaena accentuata* generally found on the foliage of trees.

Pitfall trapping

The results of the pitfall trapping exercise were disappointing. High tides during the summer backed-up the River Yare so that large areas of the site were inundated, with standing water persisting for lengthy periods in some parts. As a result few specimens were captured and these were generally in poor condition. However it was possible to identify all the mature specimens and 17 species were recorded. One of these, *Pirata uliginosus* was unique to the pitfall traps, seven males being captured during the course of the summer in a trap set at the side of Smee Loke path, and a single male captured at the end of May in a trap set in Alder Carr Marsh. This is a new record for Wheatfen and takes the site check list to one hundred and sixty eight species. It is possible that this is only the second site for this species in East Norfolk.

Acknowledgements

Thanks are due to David Nobbs (Warden) and Roy Baker (Ted Ellis Trust) for inviting the British Arachnological Society to visit Wheatfen Broad and for their help and advice during the two recording weekends. David Nobbs worked hard for the BAS team in many ways during the weekends and, in addition, set and emptied pitfall traps over an eight week period in very difficult conditions. His help was much appreciated. I am greatly indebted to Ian Dawson for allowing me to include his photographs of four species which are found at Wheatfen. Finally, thanks are due to the following members of the British Arachnological Society Rodney Allison, Dave Carr, Debra and Ian Dawson, Peter Harvey, Doug Marriott, Peter Nicholson, John Partridge, Deborah Procter, Tony Russell-Smith and Rowley Snazell were present on one or more days during the two recording weekends and whose records form the basis of this paper.

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Table 1. Checklist of the spiders of Wheatfen Broad

Key: Column A: Species collated by M.E.A.Shardlow of pre-1993 records.
Column B: Species recorded during first BAS visit 24th-25th May 2002.
Column C: Species recorded during second BAS visit 6th-8th Sept. 2002.
Column D: Species recorded in pitfall traps operated from 22nd May to 23rd July 2002.
Column E: Species identified by A.R.Jackson, in largely unidentified collection made in 1937-38 and which are now dry and shrivelled husks.

Family	Species	Status	A	B	C	D	E
Pholcidae	*Pholcus phalangioides* (Fuesslin)				x*		
Dysderidae	*Dysdera crocata* C. L. Koch		x				
	Harpactea hombergi (Scop.)				x*		
Mimetidae	*Ero cambridgei* Kulczynski		x				
Theridiidae	*Steatoda bipunctata* (L.)		x		x		
	Anelosimus vittatus (C. L. Koch)		x	x			
	Achaearanea lunata (Clerck)		x				
	Theridion sisyphium (Clerck)		x	x			
	Theridion pictum (Walckenaer)		x				
	Theridion varians Hahn			x*			
	Theridion mystaceum L. Koch			x*			
	Theridion tinctum (Walckenaer)			x*			
	Paidiscura pallens (Blackwall)		x	x			
	Rugathodes instabilis (O. P.-Cambridge)			x*	x		
	Enoplognatha ovata (Clerck)		x	x			
	Roberts lividus (Blackwall)		x	x			
Theridioso-matidae	*Theridiosoma gemmosum* (L. Koch)	Nb		x*	x		
Linyphiidae	*Ceratinella brevipes* (Westring)			x*			

Ceratinella scabrosa (O. P.-Cambridge)			x*		
Walckenaeria acuminata Blackwall		x	x		
Walckenaeria antica (Wider)			x*		
Walckenaeria nodosa O. P.-Cambridge		x		x	
Walckenaeria nudipalpis (Westri.)		x	x		
Walckenaeria unicornis O. P.-Cambridge,		x	x	x	
Walckenaeria kochi (O.P.-Cambridge)		x		x	
Dicymbium nigrum (Blackwall)		x			
Dicymbium tibiale (Blackwall)				x*	
Entelecara erythropus (Westring)			x*		
Entelecara omissa O. P.-Cambridge	Na		x*		
Moebelia penicillata (Westring)			x*		
Hylyphantes graminicola (Sundevall)			x*	x	
Gnathonarium dentatum (Wider)		x	x	x	x
Gongylidium rufipes (L.)		x	x	x	
Hypomma bituberculatum (Wider)		x	x		x
Hypomma fulvum (Bosen.)	Na	x	x		
Baryphyma trifrons (O. P.-Cambridge).		x	x	x	
Maso sundevalli (Westring)			x*	x	
Pocadicnemis pumila (Blackwall)			x*		
Pocadicnemis juncea (Locket & Millidge)			x*		
Oedothorax gibbosus (Blackwall)		x	x	x	x
Oedothorax retusus (Westring)		x		x	x
Silometopus elegans (O. P.-Cambridge)		x	x		
Cnephalocotes obscurus (Blackwall)		x			
Lophomma punctatum (Blackwall)		x	x	x	
Gongylidiellum vivum (O. P-Cambridge)		x	x		
Micrargus herbigradus (Blackwall)			x*		

Erigonella hiemalis (Blackwall)		x			
Savignia frontata Blackwall		x	x	x	
Diplocephalus cristatus (Blackwall)			x*		
Diplocephalus permixtus (O. P.-Cambridge)		x	x	x	x
Diplocephalus latifrons (O. P.-Cambridge)		x			
Diplocephalus picinus (Blackwall)			x*		
Erigone dentipalpis (Wider)		x			
Erigone atra Blackwall		x			x
Donacochara speciosa (Thorell)		x	x	x	
Leptorhoptrum robustum (Westri.)		x			
Drepanotylus uncatus (O. P.-Cambridge)		x		x	
Carorita paludosa Duffey	RDB2	x			
Aphileta misera (O. P.-Cambridge)			x*	x	
Porrhomma pygmaeum (Blackwall)		x	x	x	
Porrhomma egeria Simon		x			
Agyneta decora (O. P.-Cambridge)			x*		
Microneta viaria (Blackwall)			x*	x	
Centromerus sylvaticus (Blackwall)				x*	
Centromerus semiater (L. Koch)	RDB2	x			
Tallusia experta (O. P.-Cambridge)		x	x	x	
Saaristoa abnormis (Blackwall)		x			
Macrargus rufus (Wider)		x	x		
Bathyphantes approximatus (O. P.-Cambridge)		x	x	x	x
Bathyphantes gracilis (Blackwall,)		x	x	x	x
Bathyphantes nigrinus (Westring)				x*	
Kaestneria dorsalis (Wider)		x	x		
Diplostyla concolor (Wider)		x	x	x	
Drapetisca socialis (Sundevall)		x		x	
Floronia bucculenta (Clerck)		x			
Taranucnus setosus (O. P.-Cambridge)		x	x	x	

	Stemonyphantes lineatus (L.)			x*			
	Lepthyphantes minutus (Blackwall)		x				
	Lepthyphantes tenuis (Blackwall)		x	x	x	x	
	Lepthyphantes zimmermanni Bertkau			x*			
	Lepthyphantes mengei Kulczynski.			x*			
	Lepthyphantes flavipes (Blackwall)		x		x		
	Lepthyphantes ericaeus (Blackwall)				x*		
	Linyphia triangularis (Clerck)		x				
	Linyphia hortensis Sundev.			x*			
	Neriene montana (Clerck)		x	x			
	Neriene clathrata (Sundevall)		x	x	x		
	Neriene peltata (Wider)		x	x			
	Microlinyphia impigra (O. P.-Cambridge)		x	x			
	Allomengea vidua (L. Koch)		x		x	x	
Tetragnathidae	*Tetragnatha extensa* (L.)		x	x			x
	Tetragnatha montana Simon		x	x			
	Tetragnatha nigrita Lendl			x*			
	Tetragnatha striata L. Koch	Nb	x				
	Pachygnatha clercki Sundevall		x	x	x	x	
	Pachygnatha degeeri Sundevall		x				
	Metellina segmentata (Clerck)		x	x	x		
	Metellina mengei (Blackwall)			x*	x		
	Metellina merianae (Scop.)		x	x			
Araneidae	*Gibbaranea gibbosa* (Walckenaer)			x*			
	Araneus diadematus Clerck		x		x		
	Araneus quadratus Clerck		x		x		
	Araneus marmoreus Clerck		x		x		
	Araneus triguttatus (Fab.)			x*			
	Larinioides cornutus (Clerck)		x	x	x		
	Larinioides patagiatus (Clerck)		x				
	Nuctenea umbratica (Clerck)		x		x		
	Araniella cucurbitina (Clerck)		x	x			
	Araniella opisthographa			x*			

	(Kulczynski)				
	Zygiella x-notata (Clerck)	x		x	
	Zygiella atrica (C. L. Koch)	x		x	
	Cyclosa conica (Pallas)	x		x	
Lycosidae	*Pardosa palustris* (L.)	x	x		
	Pardosa pullata (Clerck)	x			
	Pardosa prativaga (L Koch)	x	x	x	x
	Pardosa amentata (Clerck)	x	x	x	x
	Pardosa saltans (Topfer-Hofman.)		x*		
	Alopecosa pulverulenta (Clerck)	x			
	Trochosa ruricola (Degeer)	x		x	
	Trochosa terricola Thorell	x			
	Trochosa spinipalpis (F. O. P.-Cambridge)	x			
	Arctosa leopardus (Sundevall)	x			
	Pirata piraticus (Clerck)	x	x	x	x
	Pirata hygrophilus Thorell	x	x	x	x
	Pirata uliginosus Thorell				x*
	Pirata piscatorius (Clerck)	x			
Pisauridae	*Pisaura mirabilis* (Clerck)	x	x	x	
Agelenidae	*Agelena labyrinthica* (Clerck)	x			
	Tegenaria gigantia Chamberlin & Ivie	x		x	
Cybaeidae	*Argyroneta aquatica* (Clerck)	x			
Hahniidae	*Antistea elegans* (Blackwall)	x	x	x	x
	Hahnia montana (Blackwall)	x			
Dictynidae	*Dictyna arundinacea* (L.)	x	x		
	Dictyna uncinata Thorell	x	x		
	Dictyna latens (Fabricius)		x*		
	Lathys humilis (Blackwall)	x	x		
Amaurobiidae	*Amaurobius similis* (Blackwall)	x		x	

Anyphaenidae	*Anyphaena accentuata* (Walckenaer)			x*		
Clubionidae	*Clubiona corticalis* (Walckenaer)			x*		
	Clubiona reclusa O. P.Cambridge			x*		
	Clubiona stagnatilis Kulczynski		x	x	x	
	Clubiona pallidula (Clerck)			x*		
	Clubiona phragmitis C. L. Koch		x	x	x	
	Clubiona terrestris Westring				x*	
	Clubiona lutescens Westring		x	x		
	Clubiona brevipes Blackwall		x	x		
	Clubiona subtilis, L. Koch		x	x		
	Cheiracanthium erraticum (Walckenaer)		x			
Gnaphosidae	*Scotophaeus blackwalli* (Thorell,)		x			
	Micaria pulicaria (Sundevall)			x*		
Philodromidae	*Philodromus dispar* Walckenaer		x	x		x
	Philodromus aureolus (Clerck)		x	x		x
	Philodromus praedatus O. P.-Cambridge	Nb		x*		
	Philodromus cespitum (Walckenaer)			x*		
	Philodromus albidus Kulczynski,	Nb		x*		
	Tibellus oblongus (Walckenaer)					x*
Thomisidae	*Diaea dorsata* Fabricius		x		x	x
	Misumena vatia (Clerck)		x			x
	Xysticus cristatus (Clerck)		x			x
	Xysticus lanio C. L. Koch		x	x		x
	Xysticus ulmi (Hahn)		x	x		x
	Ozyptila praticola (C. L. Koch)				x*	
	Ozyptila trux (Blackwall)		x			x
	Ozyptila brevipes (Hahn)		x			x
Salticidae	*Salticus scenicus* (Clerck)		x			
	Salticus cingulatus (Panzer)		x	x		
	Marpissa radiata (Grube)	Na	x			

	Sitticus pubescens (Fab.)			x					
Totals	**168**			**118**	**100**	**62**		**17**	**11**

Table 2. Spiders of the major habitats of Wheatfen Broad

Key: Column A: Four Acre Marsh
Column B: Thack Marsh
Column C: Alder Carr Marsh
Column D: Path alongside Old Mill Marsh
Column E: Piles of cut reed
Column F: Tussocks of the great tussock sedge
Column G: Surlingham Wood

Family	Species		A	B	C	D	E	F	G
Theridiidae	*Anelosimus vittatus*			x		x			
	Theridion sisyphium					x			
	Theridion varians					x			
	Theridion mystaceum					x			
	Theridion tinctum					x			
	Paidiscura pallens				x	x			
	Rugathodes instabilis		x	x	x			x	
	Roberts lividus								x
Theridiosomatidae	*Theridiosoma gemmosum*	Nb	x	x	x			x	
Linyphiidae	*Ceratinella brevipes*		x			x		x	
	Ceratinella scabrosa					x			
	Walckenaeria acuminata								x
	Walckenaeria antica)				x		x		
	Walckenaeria nodosa			x					
	Walckenaeria nudipalpis				x			x	
	Walckenaeria unicornis		x	x			x	x	
	Walckenaeria kochi		x	x				x	
	Entelecara erythropus						x		
	Entelecara omissa	Na	x	x	x		x	x	
	Moebelia penicillata					x			

Hylyphantes graminicola					x	x		x
Gnathonarium dentatum		x	x	x	x	x	x	
Gongylidium rufipes					x			x
Hypomma bituberculatum		x	x	x	x	x	x	
Hypomma fulvum	Na	x	x	x		x	x	
Baryphyma trifrons		x	x	x	x		x	
Maso sundevalli						x		x
Pocadicnemis pumila		x	x			x	x	
Pocadicnemis juncea		x	x	x		x	x	
Oedothorax gibbosus		x	x	x		x	x	
Oedothorax retusus		x						
Silometopus elegans		x	x			x		
Lophomma punctatum		x	x	x				
Gongylidiellum vivum			x					
Micrargus herbigradus		x						
Savignia frontata			x					
Diplocephalus cristatus			x					
Diplocephalus permixtus		x	x			x		
Diplocephalus picinus								x
Erigone atra			x					
Donacochara speciosa		x	x					
Drepanotylus uncatus		x						
Aphileta misera			x	x				
Porrhomma pygmaeum		x	x	x		x		
Agyneta decora		x				x		
Micronetа viaria						x		x
Tallusia experta		x	x	x		x		
Macrargus rufus								x
Bathyphantes approximatus		x	x	x		x	x	
Bathyphantes gracilis		x	x	x		x	x	
Bathyphantes nigrinus						x		
Kaestneria dorsalis					x	x		x
Diplostyla concolor					x	x		
Drapetisca socialis								x
Taranucnus setosus		x	x	x			x	
Lepthyphantes tenuis		x	x		x	x	x	
Lepthyphantes zimmermanni								x
Lepthyphantes mengei			x					

	Lepthyphantes ericaeus	x					x	
	Linyphia hortensis							x
	Neriene montana	x			x			
	Neriene clathrata				x	x		
	Neriene peltata				x			
	Microlinyphia impigra	x	x	x			x	
	Allomengea vidua	x	x	x			x	
Tetragnathidae	*Tetragnatha extensa*		x					
	Tetragnatha montana			x	x			x
	Tetragnatha nigrita				x			
	Pachygnatha clercki	x	x	x		x		
	Metellina segmentata				x			
	Metellina mengei		x	x	x			x
	Metellina merianae			x				
Araneidae	*Gibbaranea gibbosa*				x			
	Araneus diadematus	x			x			
	Araneus quadratus	x						
	Araneus marmoreus	x		x				
	Araneus triguttatus	x						
	Larinioides cornutus	x	x	x				
	Araniella cucurbitina		x	x	x			x
	Araniella opisthographa				x			x
	Zygiella atrica				x			
Lycosidae	*Pardosa prativaga*		x			x		x
	Pardosa amentata	x		x		x		x
	Pardosa saltans							x
	Pirata piraticus	x	x	x			x	
	Pirata hygrophilus		x	x				
	Pirata uliginosus			x				
Pisauridae	*Pisaura mirabilis*							x
Hahniidae	*Antistea elegans*	x	x	x				
Dictynidae	*Dictyna arundinacea*				x			

	Dictyna uncinata					x	x		x
	Lathys humilis		x			x			
Anyphaenidae	*Anyphaena accentuata*								x
Clubionidae	*Clubiona reclusa*		x	x	x	x	x		
	Clubiona stagnatilis		x	x			x		
	Clubiona pallidula								x
	Clubiona phragmitis		x	x	x	x	x	x	
	Clubiona lutescens						x		
	Clubiona brevipes					x			
	Clubiona subtilis			x					
Gnaphosidae	*Micaria pulicaria*						x		
Philodromidae	*Philodromus aureolus*	Nb				x			
	Philodromus albidus	Nb				x			x
	Philodromus praedatus	Nb				x			
Thomisidae	*Xysticus lanio*						x		x
	Xysticus ulmi		x	x			x		
Salticidae	*Salticus cingulatus*		x			x			
Totals	**107**		**46**	**46**	**35**	**39**	**36**	**23**	**25**

Miscellaneous observations

The soke dyke at Chedgrave Marshes on Haddiscoe Island (pH 8.1; conductivity 20.0mS.) is dominated by a scum which has floated up from the surface of the mud. This scum was produced by excess oxygen being generated by photosynthesis among the algae of the mud surface. The algae are mainly diatoms and two Cyanobacteria, *Oscillatoria limosa* and *Oscillatoria princeps.* The invertebrate fauna is dominated by *Potamopyrgus antipodarum* (Gray) Jenkin's Spire Snail on the mud surface, and to a lesser extent by *Hydrobia ventrosa* (Montagu) Spire Snail. *Potamopyrgus antipodarum* is found in freshwaters throughout Norfolk or

in those with a salinity not greater than about 20‰, whereas *Hydrobia ventrosa* cannot tolerate salinities less than 1‰, though it can live in full strength sea water. Crustacea include the brackish water species *Gammarus zaddachi* Sexton, *Gammarus oceanicus* Segerstråle, *Palaemonetes varians* (Leach) and *Sphaeroma rugicauda* Leach. A survey of the distribution of *Gammarus* species along the salinity gradient of the Limfjord, in Denmark showed *G. zaddachi* tolerating salinities from <1% to >10% whilst *G. oceanicus* has a tolerance ranging from 19% to above 30% salinity. The specimen of *Gammarus oceanicus* collected in the soke dyke at Chedgrave Marshes is the **first record** of this species for Norfolk (ident. Dr R.Hamond and now in his collection). Hamond (1967) noted that it is abundant in Scotland and extends (albeit in small numbers) as far south as Robin Hood's Bay in Yorkshire. The polychaete worm *Nereis diversicolor* Müller is also present in low densities.

Keith Clarke, Roy Baker, Derek Howlett

The **small red damselfly *Ceriagrion tenellum*** was first reported breeding in Norfolk on 3rd August 1955 (Durrant 1960, Rare dragonflies in Norfolk *Trans. Norfolk & Norwich Nats' Soc.*. **19 (2),** 76-77) when a small colony was found and several pairs seen *in copula.* at Scarning Fen. However, Ken Durrant (*pers comm*) says that as far back as 1937 he knew of a colony of this species at this site when it was present in quite big numbers for many years. This small Norfolk Wildlife Trust Reserve near Dereham is still the only known site in Norfolk for this species and is apparently also the only extant one in East Anglia. In recent years sightings have continued but in very small numbers with some years no records at all so that the long-term future of the colony has remained in doubt. Thus, it is heartening to report that a male of this species was seen on 15th July 2002 flying around the small *Sphagnum* pools where it breeds (see plate). The common large red damselfly *Pyrrhosoma nymphula* also occurs at Scarning and flies at the same time.

Geoff Nobes

THE SOUTHERN EMERALD DAMSELFLY *LESTES BARBARUS* (FAB) THE FIRST BRITISH RECORD

Geoff Nobes
Springside, Carbrooke, Thetford IP25 6SQ

On 30th July 2002 I decided to spend a day at Winterton Dunes, Norfolk, hoping to see small red-eyed damselfly *Erythromma viridulum,* as I had seen the species there the previous year. The site in question was a small pool behind the main ridge of the dunes, but there was no sign of any small red-eyed damselfly and only blue-tailed damselfly *Ischnura elegans* and common darter *Sympetrum striolatum* were flying. The day was cloudy, so I walked around the perimeter of the pool to see if I could flush any roosting dragonflies, whereupon a large *Lestes* damselfly was noticed perched on nearby vegetation. I could immediately see that it was something unusual by the striking bicoloured pterostigma.

At home, upon consulting Askew (1988) I found that I had seen a male southern emerald damselfly *Lestes barbarus* - the first record for Britain. No other specimens were seen that day or on another visit two days later. A third visit to the site on 7th August turned up two further males (different individuals to the original insect). Again one was seen clinging to vegetation two metres from the pond. The second specimen was flying around and perching on reedmace *Typha latifolia.*. No more specimens were seen, in spite of a thorough search, and no evidence of breeding was noted. A fourth and final visit was made on 22nd August but the only odonata present on the pond were emerald damselfly *L. sponsa,* common darter and ruddy darter *Sympetrum sanguineum.* Some time was spent searching the other ponds on the dunes but no more *L. barbarus* were found.

Lestes barbarus is a noticeably larger species than our two native *Lestes* with a body length of 40-45mm compared to 38mm in the other species. The wingspan is also larger - up to 46mm compared to 36mm in scarce

emerald damselfly *L. dryas*. The most distinctive feature of *L. barbarus* is the bicoloured pterostigma, the apical third being whitish and the basal part brown. This is very noticeable even from some distance when the damselflies are mature, though the contrast can be less obvious in very immature individuals. Also distinctive are the broad yellow thoracic stripes. The male inferior abdominal appendages have divergent finger-like apices (plate ?) and are yellow rather than the dark colour of the British species. The lower posterior part of the head (between the mouth opening and the neck) is yellow, whereas in *L. dryas* and *L. sponsa* it is bronze-green. There is more yellow on the dorsal surface of the abdomen than in other *Lestes* species. It is also worth noting that males of *L. barbarus* show less in the way of blue pruinescenee than males of the British species, the abdomen of even fully mature individuals having blue restricted to only a small spot on segment S10.

Biology

Lestes barbarus has a one-year life cycle and is said to breed in stagnant, sometimes brackish water. The female oviposits in *Juncus, Carex, Alisma* and other similar plants, as well as in the branches of trees. Under many conditions insects tend to remain faithful to the ponds in which they developed, so that colonization of new sites can be slow (Utzeri *et al.* 1984) though this is apparently not always the case.

Flight Period

Lestes barbarus has a long flight period in Europe - from May until the end of October. The peak emergence in Italy is mid-May (Carchini & Nicolai 1984) but markedly later further north.

Distribution

In Europe *L. barbarus* is mainly Mediterranean in distribution, being widespread in Spain, Italy and southern France, and becoming progressively more local northwards to the Channel Islands (Merritt *et al.* 1996). It has bred on Alderney but could not be found during a survey in 1978 (Belle 1980); neither had it been seen on Jersey for many years until its

rediscovery in 1995 (Long & Long 2000). Until recently it was uncommon in Germany and Austria; only a few isolated colonies existed in Belgium, Holland, Denmark (Nielsen 1979) and Poland (Mielewcyk 1972). The last decade or so has, however, seen something of a range expansion. The most northerly record is from Kullaberg in Sweden (Ander 1963). It is also found in North Africa, Iran and the south of the USSR east to India and Mongolia.

Habitat at Site of Discovery

Winterton Dunes National Nature Reserve (NNR) covers 108ha and consists of an extensive dune system on the east coast of Norfolk. The NNR is part of the Winterton-Horsey Dunes Site of Special Scientific Interest .

Lestes barbarus was observed by a shallow, stagnant, muddy dune pool in an area of marsh behind the main dune system (Plate 6). The pool was rapidly drying up and was only 0.5m deep, but had been deeper earlier in the year. The pool contained no submerged aquatic vegetation at all, but a clump of greater reedmace was growing in the deepest part. Jointed rush and marsh pennywort were present around the edges. The water was very cloudy with suspended mud, but a total of 15 species of water beetles and five species of water bugs were identified. Also found were smooth newt larvae, mayfly nymphs *Cloeon dipterum* and the larvae of blue-tailed damselfly, broad-bodied chaser *Libellula depressa* and brown hawker *Aeshna grandis*. Small red-eyed damselfly is thought to have bred in the pool the previous year, but no larvae or exuviae were found. Perhaps the water beetles and newts had eaten them all.

Weather Conditions at the Time

The weather was changeable in the last week of July with sunny intervals, cloud, light northerly winds and a temperature between 20-25^{0}C. On 7th August (the day of the second sighting) the winds were still in the north but had picked up to a moderate breeze.

Examination of meteorological weather charts by Peter Davey showed that

the last few days of July up until the date of the second sighting were dominated by a light and warm airflow from northern Europe. Winds veered from north-west through to east and though originating in northern Europe did result in an airflow from the Netherlands across to East Anglia at times, which would make this a potential source of origin.

The period between the end of July and the date of the second sighting was a time of significant insect immigration that included a small influx of Camberwell beauty *Nymphalis antiopa* and bedstraw hawk-moth *Hyles gallii* into eastern England. Rare moths recorded in south-east England during this period included dusky hook-tip *Drepana curvatula,* Lydd beauty *Peribatodes ilicaria,* spurge hawk-moth *Hyles euphorbiae,* three-humped prominent *Notodonta tritophus,* scarce dagger *Acronicta auricoma* and tree-lichen beauty *Cryphia algae.* Interestingly, on 8th August 1,800 diamond-back moth *Plutella xylostella* were recorded at Scolt Head, Norfolk (J. Clifton), and 1,000 were seen flying around heather flowers at Winterton Dunes on 10th August (Hipperson 2002).

Next Season

Whilst there is a possibility that *L. barbarus* could have bred at Winterton Dunes in 2002, the sporadic nature of the sightings, apparent lack of females and coincidence with a very obvious period of insect immigration into south-east England suggests that the individuals seen were primary immigrants. However, inevitably there will be some interest in looking for the species in the 2003 season.

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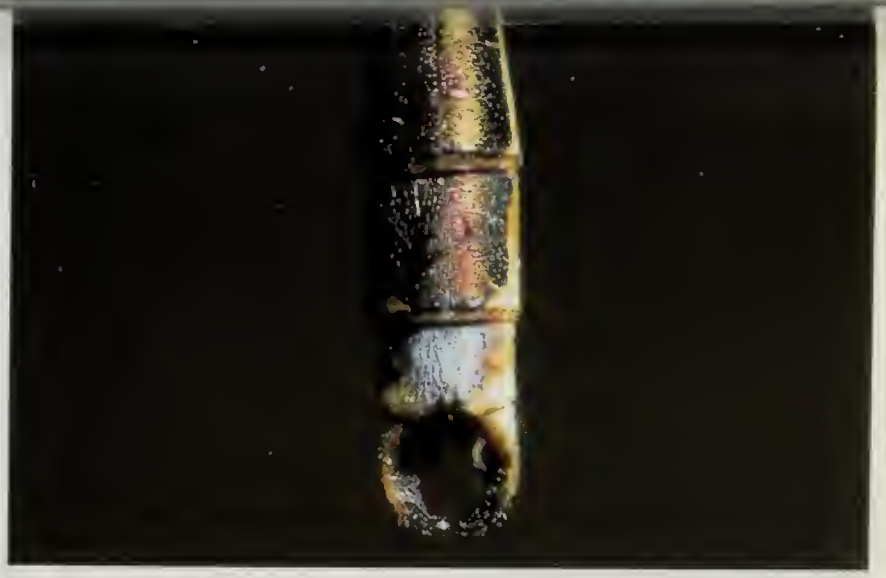
PLANT NOTES 2002

Gillian Beckett & Bob Ellis

The botanical year started early with Ron Payne out botanising in January finding a new colony of the locally scarce hard fern, *Blechnum spicant* beside a wet, woodland ditch in Watlington. While making a study of the whole area of this parish, he also recorded a hybrid grass, *Lolium* x *boucheanum* for which there is only one other W. Norfolk record. There is a great deal to be said for close study of a small area, especially if it has some good habitats and there can be no better example than Laurie Hall's detailed survey of the parish of Felthorpe. Three years ago he astounded us all by finding leafy rush, *Juncus foliosus*, which was new to East Anglia. In 2002 he has discovered smooth-stalked sedge, *Carex laevigata,* new to the county. The identity of this sedge was kindly confirmed by Clive Jermy. A number of young plants of hard fern have also turned up at Wheatfen, Surlingham. These plants are all of a similar age and are undoubtedly from

Southern Emerald Damselfly *Lestes barbarus* (Fabr.). Male, Winterton Dunes NNR, Norfolk. 30 July 2002 (Photo: G. Nobes)



Southern Emerald Damselfly *Lestes barbarus* (Fabr.). Male, showing divergent inferior anal appendages (Photo: G. Nobes)

Searce Emerald Damselfly *Lestes dryas* Kirby. Male, showing convergent inferior anal appendages (Photo: G. Nobes)

Mousetail *Myosurus minimus* (Photos R. Ellis)

Bird's nest orchid. *Neottia nidus-avis*

Yellow bartsia *Parentucellia viscosa*

recently germinated spores. It will be interesting to see if they mature and persist.

One of the most exciting records of the year was that of a large colony of May lily, *Maianthemum bifolium*, found by R. Garrad at Salthouse. In June, members of the Flora Group were delighted to see some fine specimens of the scarce greater water-parsnip, *Sium latifolium*, at Bridgham, which were first spotted by Margaret Austen. 2002 also turned out to be a good year for orchids with a number of plants of bee orchid, *Ophrys apifera* reported, especially along the edge of the A10 where bare soil was exposed last year by road improvements; less usual were two plants of bird's nest orchid, *Neottia nidus-avis*, found by Eric Rogers in a good, coppiced wood and narrow-leaved helleborine, *Epipactis phyllanthes* which was seen near Dereham by David & Barbara Mathias.

Less obvious but unusual were finds of small water-pepper, *Persicaria minor* at Litcham by Bob Ellis and Robin Stevenson and of round-fruited rush, *Juncus compressus*, normally a plant of coastal marshes but found inland at Hilborough by Alec Bull who also spotted a rare coastal plant, Ray's knotgrass, *Polygonum oxyspermum* ssp. *raii* at Blakeney. This subspecies was reported independently from the same site by Craig Robson, who also recorded slender hare's-ear, *Bupleurum tenuissimum*, from the north bank of Breydon Water. Glen Cooper found the delightful but diminutive mousetail, *Myosurus minimus,* at Neatishead. A number of plants of the scarce grass, loose silky-bent, *Apera spica-venti*, were seen during the N&NNS excursion to Felmingham in July. The Flora Group at Thornham, in late summer, were also pleased to see the colony of sharp rush, *Juncus acutus* there was flourishing, as was long-bracted sedge, *Carex extensa* and the small, rare sea-lavenders.

Most of these are native plants, but several garden escapes and other recent alien species have turned up. A second colony of the less usual species of globe-thistle, *Echinops banaticus* was noted near Swaffham by Ken Beckett. This was obviously a garden throw-out, but the origin of plants of yellow bartsia, *Parentucellia viscosa* noticed at Dereham by David &

Barbara Mathias is more puzzling as it has no very obvious means of spreading to new areas. It was also seen on the edge of an old runway near Thursford by Tim Doncaster where it was noticed first in 1955, but not then passed on to the county recorders. Bill Mitchell and colleagues found lesser Caucasian-stonecrop, *Sedum stoloniferum,* well established by a similar concrete track at Bedingham. Mary Ghullam found witch-grass, *Panicum capillare,* in North Walsham where she also discovered sea fern-grass, *Catapodium marinum.* This maritime grass has occasionally turned up on salted roads but an urban setting is unusual. Tony Irwin discovered Japanese wineberry, *Rubus phoenicolasius* in Cringleford Wood, presumably deposited by a passing bird and another first for the county was a single plant of a European species of burdock, *Arctium tomentosum* found by Alec Bull in a set-aside field at East Tuddenham, possibly originating from bird seed.

Last year we included an item on the newly introduced *Conyza sumatrensis*, there is no doubt how this travels about with its mass of light fruits. Records up to this year have always been urban, but Ken & Gillian Beckett found a flourishing colony on a sugar-beet pad at Barwick. A habitat like this should mean that it gets free and fast transport around the county, so watch this weed! * Finally, just to prove that botanising never stops, Alec Bull found a flowering plant of *Persicaria capitata* between pavement cracks in the Market Place at Dereham on December 10th.

* Note details of the three potential species of *Conyza* in Trans. NNNS Vol **35**(1) 67-71

NOTES FROM *'THE NORFOLK NATTERJACK'*

Since I took over as editor for *'The Norfolk Natterjack'* at the end of 1998 I have received many interesting notes and observations. It has occurred to me that some of these notes relate to 'new to Norfolk' or rarely observed species and should be preserved in *'Transactions'* as a more permanent record. The following selection covers issues 63-79 from November 1998 to November 2002.

Issue no. 63 (November 1998)
Red-breasted carrion beetle *Oiceoptoma thoracicum* (5 pairs) A Norfolk wood - May 1998, Reg & Lil Evans.

Issue no. 64 (February 1999)
Snail *Vertigo angustior* Saxlingham Thorpe, 3rd recorded county site - August 1998, Roy Baker, Derek Howlett.
Bivalve *Corbicula fluminea* River Chet, Reedham, 1st county and UK record - October 1998, Roy Baker, Derek Howlett.
Ostracod *Cypris bispinosa* West Mere, Tottingham, 1st county and 3rd UK record - November 1998, Roy Baker, Derek Howlett.
Hybrid Japanese knotweed *Fallopia* x *bohemica* Hempstead, nr. Holt, 1st county and East Anglian record - November 1998, Tony Leech.

Issue no. 65 (May 1999)
Sandy stilt puffball *Battarea phalloides* Drayton - March 1999, Tony Howes.

Issue no. 67 (November 1999)
Hare's ears *Otideaa onotica* and *Plicaria trachycarpa,* both cup fungi, Holt Lowes - October 1999, Tony Leech.
Nathusius's pipistrelle *Pipistrellus nathusii.* North-east Norfolk. Bat detector record July 1998, John Goldsmith. Possible 1st county record.

Issue no. 68 (February 2000)
Salticid spider, *Marpissa muscosa*, Breckland - 1997, Garth Coupland

Issue no. 70 (August 2000)
Woodlouse *Androniсus dentiger* Wacton - August 1999, Robert Maidstone.

Issue no. 72 (February 2001)
Fungus *Monilinia johnsonii* (on fallen hawthorn berries) Wacton - March 2000, Robert Maidstone.

Issue no. 73 (May 2001)
Mould *Botrytis galanthina* (on snowdrop leaf bases) Tibbenham - 2001, Robert Maidstone.
Sea slater *Ligia oceanica* Wells-next-the-sea - 2001, Paul Banham.

Issue no. 74 (August 2001)
Channel wrack *Pelvetia canaliculata* Overy Staithe, 2nd county site - 2001, Paul Banham.

Issue no. 75 (November 2001)
The eared plant bug *Ledra aurita* Scole, nr. Diss - 2001, Mike Hall,Ken Durrant.
Yellow-necked mouse Wheatfen - May 2001, Colin Jacobs, David Nobbs.
Bee wolf *Philanthus triangulum* Beeston Regis Common - August 2001, Ken Durrant, Francis Farrow.
Hoverfly *Volucella inanis* Beeston Regis Common, possible 3rd county site - August 2001, Ken Durrant, Francis Farrow.
Harvestman *Dicranopalpus ramosus* Beeston Regis Common - August 2001, Francis Farrow.

Issue no. 76 (February 2002)
Fungi *Gymnopilus dilepis* Beeston Regis Common, 1st county and 3rd UK record - August 2001, Francis Farrow, Tony Leech.
Leaf-minor fly *Phytomyza hellebori* Bressingham - November 2001, Mike Hall.

Issue no.78 (August 2002)
May lily *Maianthenmum bifolium* North Norfolk heath, 3rd county site - June 2002, Roger Garrad.
Hybrid sundew *Drosera x obovata* Beeston Regis Common - July 2002, David Mower.

Issue no. 79 (November 2002)
Oak trunk aphid *Stomphis quercus* Wacton - August 2002, Robert Maidstone.
Jet black ant *Lasius fuliginosus* Wacton - August 2002, Robert Maidstone.
Pine sawfly *Diprion pini* Thorpe, nr. Norwich - October 2002, Tony Howes.
Pond skater *Aquarius paludrum* Beeston Regis Common, possible 1st county record - September 2002, Ken Durrant.

Francis Farrow - Editor *The Norfolk Natterjack*

WEATHER SUMMARY FOR 2002

J. Graham Hilton
Morley Research Centre, Wymondham NR18 9DB

Details of rainfall, sunshine and mean temperature for 2002 compared with the long-term averages are given in table 1. Data on the rainfall for the year and how they compare to the 34 year mean are presented graphically in figure 1, while the same is shown for sunshine hours in figure 2 and mean temperature in figure 3.

The mean temperature for 2002 (10.5^{0}C) was 1.0^{0}C above the long-term average, and was the highest for 12 years. Rainfall (701.2 mm) was the lowest since 1997; but was still 11% above the long-term normal. It was the fifth consecutive year with more than 750mm rainfall. Sunshine (1405.6 hours) was 143.2 hours below the average.

The rainfall for **January** was near to normal, whilst sunshine was the lowest for six years. It was the mildest since 1993. Daytime temperatures were below normal for the first eleven days, and severe frosts occurred on the 1st and 2nd . – 11.4 ^{0}C (2nd) was the lowest ground frost since 1993. Fogs persisted from the 5th to the 8th. This period was predominantly dry. Above average temperatures were recorded for the rest of the month and it was particularly mild after the 19th with daytime temperatures above 10^{0}C on most days and above 12^{0}C on six. Rain fell on every day after the 22nd except for the 29th.

February was the warmest for 12 years and rainfall was 150% of the normal. Sunshine was slightly above the long-term average. The first 12 days were mild with no air frosts and only one slight ground frost. It was exceptionally mild on the 11th when the minimum temperature did not fall below 10.5^{0}C; the warmest since 1928. Above-average maximum temperatures persisted until the 19th but it was cold at night from the 14th to the 17th when air frosts were recorded. Spells of wintry weather were

experienced on the 23rd and 24th . Driving snow fell on the 23rd and this part of the month was noticeably wet.

March was the driest for two years and the mildest for three. It was the sunniest since 1997. A cold beginning gave way to mild weather from the 4th to the 12th. Temperatures remained near to or slightly above normal for most of the month. Ground frosts were frequent during the last week; long sunny spells occurred from the 27th to the 30th

April was the driest since 1997 and the sunniest since 1990. The mean temperature was 1.3°C above the long-term average. The month was predominantly dry and light showers fell on only two days up to the 25th. The remainder of the month was showery with heavy falls on the 28th (9.4 mm) and persistent rain on the 30th (11.0 mm). Sunny spells were commonplace until the 25th.

May was the dullest since 1991 with 41.9 fewer sunshine hours than April. Rainfall was 25% above the long-term average. The mean temperature was the lowest for six years. Daytime temperatures were below normal for the first 11 days. Ground frosts formed on first four nights and the month was then frost-free. The third week was noticeably warm and sunny and it was quite windy at times during the second half of the month. Rain was recorded on every day from the 20th to the 30th.

Rainfall for **June** was only 66% of the long-term average and the mean temperature was 1.0°C above normal. Sunshine was the lowest for four years. Temperatures were above normal from the 14th to the 26th and it was noticeably warm on the 17th (28.6°C). Thunderstorms on the 18th produced a total fall of 15.8 mm. Sunny spell were frequent after the 16th.

July was the wetter than normal and sunshine was 20 hours below the long-term average. The mean temperature was 1.3°C below normal until the 25th, when warmer weather for the rest of the month brought the figure to nearer the long-term figure. The first 9 days were mostly cloudy with spells of rain, but sunnier and drier weather was recorded from the 12th to the 19th.

The weather turned warm and sunny on the 25th and was even warmer the next day (28.6°C). Thunderstorms built up for the last few days of the month and 9.6mm fell in a storm early on the 31st.

August was the warmest since 1997 and the driest for two years. It was a predominantly damp month and sunshine was only 75% of the long-term normal. It was particularly warm from the 13th to the 19th and 25°C was exceeded on six days during this period. The temperature did not fall below 17.4°C on the 19th. Thundery showers fell on the 18th. Fog was recorded on the 19th and did not clear until late morning.

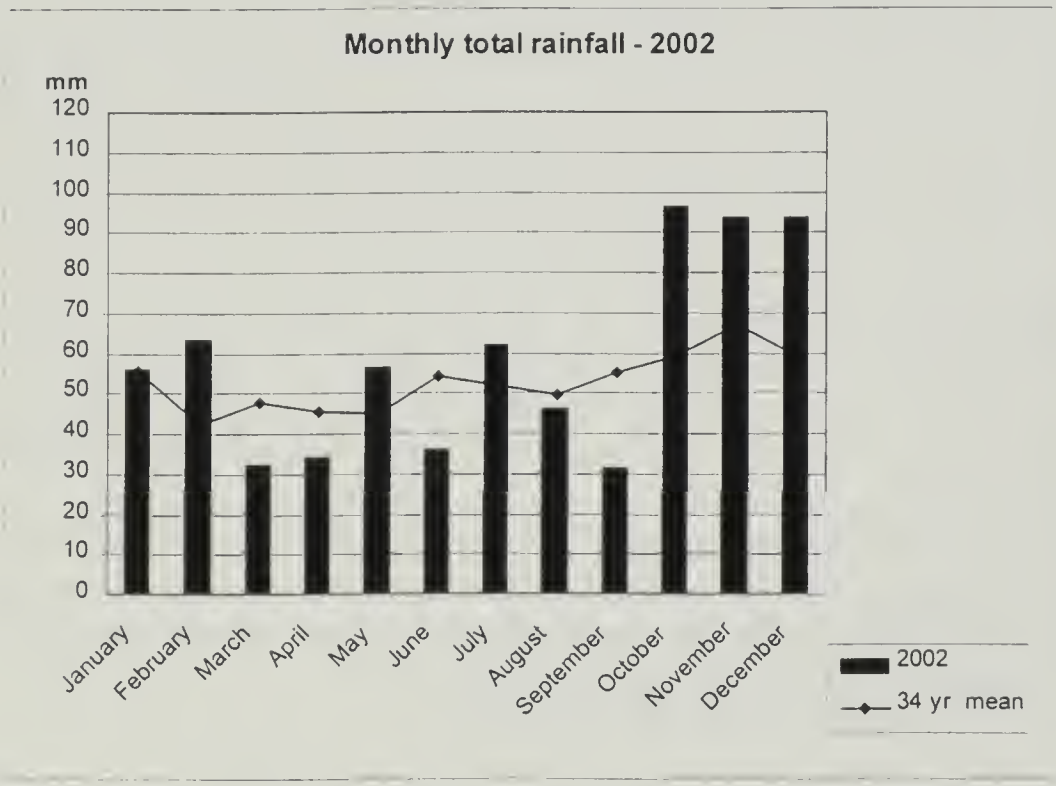
September was the driest since 1997. The mean temperature was equal to the long-term average. Sunshine was the highest for three years, but it was still 11.9 hours below the long-term average. Normal temperatures, sunny spells and dry conditions gave way to cool cloudy weather on the 8th. Heavy rain fell on the 10th (17.2 mm). Dry weather prevailed from the 10th to the 21st, but it was only sunny at times and northerly winds from the 14th to the 17th resulted in overcast skies and below normal temperatures.

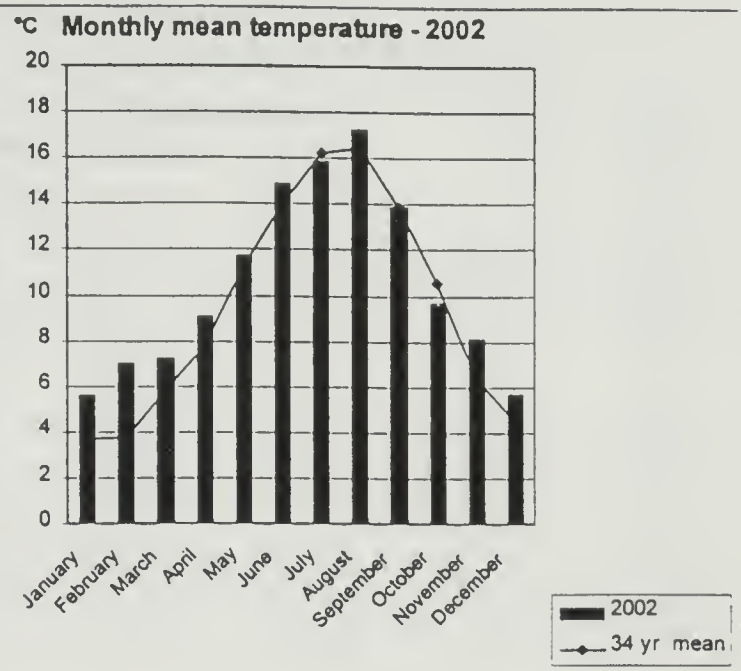
October was the coolest since 1993. It was the wettest and dullest for two years with 163% of the long-term rainfall. The 1st was the only day of the month to exceed 20°C. The first October air frost since 1997 was recorded on the 20th and was accompanied by a ground frost of –3.3°C. Spells of almost continuous rain on the 12th (10.2 mm) heralded a period of very wet and dull weather. Significant falls of 6.2 mm (13th), 9.2 mm (14th) and 35.0 mm (15th) were recorded; the last being the wettest October day since 1993. Rain fell on several more days during the rest of the month. Gales on the 27th resulted in structural damage in many places.

November was the cloudiest for seven years and rainfall was 39 percent above normal. It was the fourth consecutive November with the mean temperature above 7.0°C (8.1°C; 1.7°C above the long-term average) and was also the mildest for five years. The first six days were much milder than normal. Prolonged rain (13.6 mm) fell on the 2nd and heavy rain fell on the 6th (14.4 mm), 8th (20.8 mm), 10th (6.8 mm),12th (6.6 mm) 13th (6.2 mm)

and 14th (4.2 mm). Patchy fog formed on the 16th and 17th and again on the 23rd, 25th and 26th.

December was the wettest for five years. Sunshine was the lowest since 1969 and the mean temperature was 1.2°C above normal. The first six days were mild and cloudy and moderate falls of rain were recorded. Below normal temperatures occurred from the 7th to 20th and ground frosts formed at times. Only four sunny days were recorded from the 8th to 20th. Heavy rain fell on 22nd (21.4 mm) and 29th (24.8 mm) and moderate falls occurred earlier in the month.




°C Monthly mean temperature - 2002
20
18
16
14
12
10
8
6
4
2
0
January
February
March
April
May
June
July
August
September
October
November
December
2002
34 yr mean

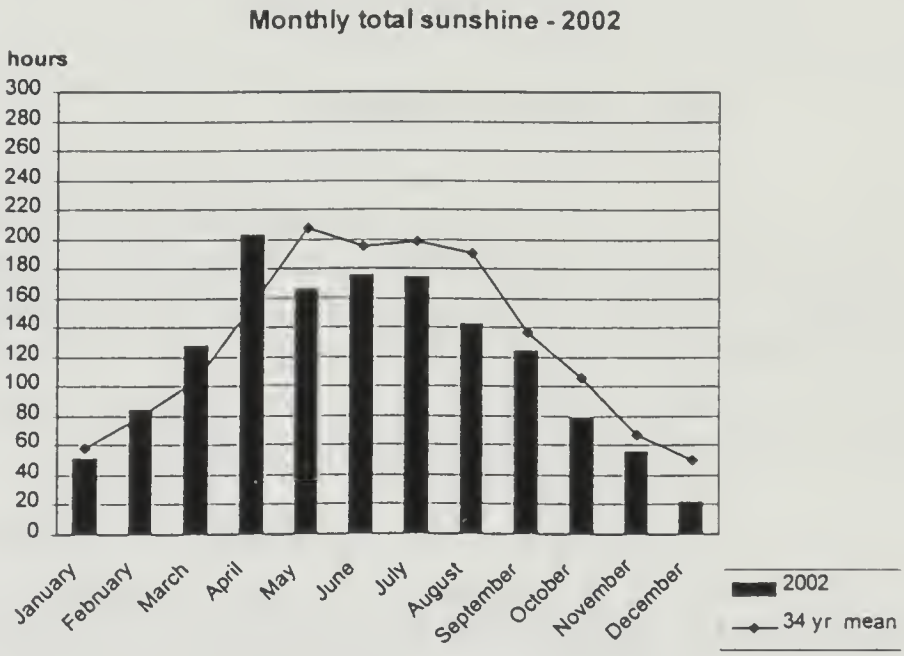

Monthly total sunshine - 2002
hours
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
January
February
March
April
May
June
July
August
September
October
November
December
2002
34 yr mean

Table. *Weather records for Morley 2002*

	Rainfall (mm)		Sunshine (hours)		Mean temperature (°C)	
	1969-2002 34 yr mean	2002	1969-2002 34 yr mean	2002	1969-2002 34 yr mean	2002
January	55.6	56.0	58.3	51.7	3.7	5.6
February	42.4	63.6	79.9	83.9	3.8	7.0
March	48.0	32.4	104.7	128.2	5.8	7.2
April	45.6	33.8	154 8	203.0	7.8	9.1
May	45.2	56.4	207 2	164.9	11.2	11.7
June	54.2	36.0	195.1	175.9	13.9	14.9
July	52.2	62.0	198.4	174.4	16.2	15.9
August	49.6	45.8	190 1	142.5	16.4	17.3
September	55.2	31.2	136.7	124.8	13.9	13 9
October	59.1	96.4	106.0	78.8	10.5	9 7
November	67.4	93.8	67.7	55.4	6.4	8.1
December	59.5	93.8	49.8	22.1	4 5	5.7
Total	633.9	701.2	1548.8	1405.6		
Mean					9.5	10.5

WILDLIFE 2000

During its 125th anniversary celebrations, the Norfolk and Norwich Naturalists' Society announced its intention to document the wildlife of Norfolk for the start of the new millennium in a project called **Wildlife 2000.** In practical terms the project was launched in May 1995 when representatives of the Society, English Nature, Norfolk Wildlife Trust and the Castle Museum met and agreed to share this common vision.

Sir Thomas Browne has given us a fascinating glimpse of seventeenth century wildlife in the County of Norfolk. He writes of bustards, storks, ravens and kites; salmon and otters; and the mole cricket which he describes as common in "*fenny places.... and dunghills and churchyards in this citty.*"

Nineteenth century records of the mole cricket from Castle Acre and Stoke Holy Cross suggest a lingering presence for this species in river flood plains across the county, but we are left tantalisingly ignorant of its historic distribution. How widespread was it, how abundant where it did exist, and until how recently did it survive?

Wildlife 2000 is a project designed to ensure that twenty first century naturalists will have the answers to the equivalent questions they might ask about our flora and fauna, as they approach the end of their own century.

Wildlife 2000 seeks to create a "time capsule" which will preserve our knowledge of the countryside, and what could be found in it at the start of the third millenium. The project is not just concerned with nature reserves and rare species, but seeks to give an accurate account of the wider countryside and the commoner species which abound within it.

Just as the mole cricket was common in Thomas Browne's day but is now lost, so any other creature or plant which we take for granted could become rare or extinct over the next century. By documenting the wildlife heritage which we pass into the care of the twenty first century, those who come after us may be in a better position to preserve and protect that legacy.

WILDLIFE 2000 Publications

Trans. Norfolk Norwich Nat. Soc. 1997; **31**(1)

MOORE, L. Chalk grassland in Norfolk. 1-30

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