EAST OF ENGLAND APPLE AND ORCHARD PROJECT

MOLLUSCA AND DIATOM SURVEYS 2005

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INTRODUCTION

The Apple and Orchard Project aims to examine selected groups of animals and plants found in five diverse orchards spread across the Norfolk. The surveys form part of Norfolk County Council's biodiversity programme which is linked to the East of England Apple and Orchards Project.

SURVEY

Each of the five selected orchards was visited during July-August 2005. Whilst the larger molluscan species were identified on site for the smaller species samples of leaf litter and mosses were collected and examined at a later time under the microscope. The diatom survey relied on collections of litter and mosses for both light microscopic and scanning electron microscope examination.

The five orchards showed a range from a commercial plum orchard with managed rides, rows of trees and limited spraying to old non-commercial orchards with management from maintaining grass swards to total neglect. In some cases shading by the trees excluded a vibrant ground flora whilst in others an open grass/buttercup sward resulted**.**

A feature of some of the orchards is the removal of fallen branches and older dead trees. This effectively eliminates many habitats for both slugs and snails. However, in the walled orchard brick and stone rubble on the margins did compensate for the lack of dead timber. In addition some orchards retained pallets which, when unused, allowed some species to congregate.

The number of molluscan species present in these five orchards was low (9-12 per orchard). Only a few species can be described as being ubiquitous to the orchards. This is unsurprising given the wide range of management strategies used by the owners. A total of twenty seven species were recorded from a total terrestrial count of one hundred and nineteen across the U.K. In terms of biodiversity the orchards hold 23% of the terrestrial mollusca found in Britain and since a number of this total are restricted to montane or coastal habitats the Norfolk orchards can be seen as important sites for slugs and snails.

Although the algae of tree trunks in Norfolk have been studied for over a century (Kitton 1884) recently there has been a renewal of interest in the algae of mosses on trees especially around Cambridge (Belcher and Swale 1997, 2005). The present survey has allowed a study of the diatoms in the five orchards, especially on the moss of the trees. This has resulted in the study of an interesting diatom similar to *Achnanthes didyma.*

References.

KITTON, F., 1884. Fauna and flora of Norfolk Diatomaceae. *Transactions Norfolk and Norwich Naturalist's Society* **111**: 754-770

BELCHER, J.H. & SWALE, E.M.F., 1997. *Orthoseira dendroteres* and other diatoms epiphytic on bryophytes near Cambridge. *Nature in Cambridge* No **39**: 37-39

BELCHER, J.H. & SWALE, E.M.F., 2005. Some preliminary observations on algae and associated micro-organisms of sub-aerial habitats, particularly among mosses near Cambridge. *Nature in Cambridge.* No **47:** 60-68

ALDEBY: NORFOLK

Location The Orchard, Common Road, Aldeby

Grid reference TM 462 935

History Disused mixed smallholding of about 3 acres. This is the site of an orchard since the 16thC. It was originally bought by the owners in the late 17thC.Last managed in late 1970s. The owner reports that there are over 70 different cultivars present most dating from 1920s. Some are pre1900. Mainly apples with some plums and pears.

Survey The orchard is very overgrown, although the dense leaf canopies of the trees do mean that there is little ground cover other than prostrate ivy with occasional arum lily. Where the canopy is more open stinging nettles 2m high dominate, although the ground cover beneath them is essentially ivy. There are stands of mosses covering some of the soil. There is little leaf litter. Fallen branches are few such that rotting logs are not a feature of this orchard. The overall picture is of a habitat offering limited ecological factors for snails and slugs. However, the fruit does provide a ready supply of food for the slug species.

The soil is friable and derived from chalky boulder clay.

Mollusca *Cochlicopa lubrica* (Müller) Slippery moss snail. A catholic species common in all types of damp, sheltered places. Noted in ground litter in orchard. **Common**

Discus rotundatus (Müller**)** Radiated snail. Typical of a wide range of habitats in ground litter of both deciduous and coniferous woodlands. **Occasional**

Arion hortensis Férussac. Garden slug. A known garden pest. Found underlogs and in litter in orchard. **Frequent**

Vitrea crystallina (Müller) Crystal snail. A catholic species found in a wide range of habitats including woodlands. Found in leaf litter. **Occasional**

Nesovitrea hammonis (Ström.) Rayed glass snail. Common in vegetation and litter in a wide range of habitats. Found in orchard litter. **Common**

Aegopinella pura (Alder) Clear glass snail. A species of deciduous woods in leaf litter. **Common**

Aegonpinella nitidula (Drap.) Smooth glass snail. In ground litter. **Occasional**

Cochlodina laminata (Montagu) Plaited door snail. A snail of deciduous woodland where it lives among moss, leaf litter and fallen timber. Typical of base-rich soil. **Frequent**

Clausilia bidentata (Ström.) Two-toothed door snail. Prefers ground litter in woods and hedges on calcareous soils. Found on some apple trunks and in leaf litter. **Common**

Trichia striolata (Pfeiffer) Strawberry snail. Amongst nettles. **Frequent**

Arianta arbustorum (L.) Copse snail. In leaf litter/ nettles and in lower tree branches. **Common**

Cepaea hortensis (Müller) White-lipped snail. Lives in a wide range of habitats including woods. Found in litter and on apple trees. **Common**

Diatoms

The ground was mostly covered with ivy but there were some tufts of ivy on the lower branches of the trees. Pieces from one tuft were washed and the washings examined by me (Keith Clarke) and Dr Frances Green.

Nitzschia palea
Nizschia constricta
Nitzschia microcephala
Nitzschia amphibia
Nitzschia sigma
Navicula lanceolata
Navicula gregaria
Navicula tripunctata
Navicula cari
Achnanthidium minutissimum
Planothidium lanceolatum
Gomphonema parvulum
Syenedra ulna
Suriella brebissonii
Cocconeis placentula

A shallow valley to the west of the orchard has been dammed to form a small pool. The margins had been improved by excavator and numbers of aquatic plants grew there. The diatoms were prepared from epiphytic material washed off the plants. Studies were made by me (Keith Clarke) and Dr Ros Boar (University of East Anglia).

Nitzschia recta
Nizschia palea
Nitzschia inconspicus
Nitzschia amphibia
Nitzschia dissipata
Navicula radiossa
Navicula gregaria
Navicula cincta
Achnanthidium minutissimum
Planothidium lanceolatum
Gomphonema parvulum
Gomphonema acuminatum
Gomphonema olivaceum
Syenedra fasciiculata
Synedra acus
Epithemia turgida
Amphora veneta
Amphora pediculus
Rhoicosphenia abbreviata

Ctenophora pulchellum
Rhodalodia gibba

WALPOLE HIGHWAY: NORFOLK

Location The White House, Lynn Road, Walpole Highway

Grid reference TF 514 138

History A mixed smallholding of about 2-3 acres. Orchard mainly of apples with some plum and pear trees. Many different cultivars present of various ages. Some c. 1900. Managed organically for the last ten years. The orchard is about 100 years old.

Survey The orchard is overgrown in places, although the dense leaf canopies of the trees do mean that there is little ground cover other than prostrate ivy in the shaded places. In more open locations grasses and nettles dominate There are stands of mosses covering some of the soil near the drainage ditches. There is little leaf litter. Fallen branches are few such that rotting logs are not a feature of this orchard. There is some mowing of pathways to the beehives. The overall picture is of a habitat offering limited ecological factors for snails and slugs. However, the fruit does provide a ready supply of food for the slug species.

The soil is derived from fenland peat.

Mollusca *Cochlicopa lubrica* (Müller) Slippery moss snail. A catholic species common in all types of damp, sheltered places. Noted in ground litter in orchard. **Common**

Arion ater (L.) Large black slug. Recorded in marginal grass/nettle vegetation and under logs, beehives (unused!!). **Abundant**

Arion hortensis Férussac. Garden slug. A known garden pest. Found under logs and in litter in orchard. **Frequent**

Aegonpinella nitidula (Drap.) Smooth glass snail. In ground litter. **Occasional**

Oxychilus draparnaudi (Beck) Draparnaud's glass snail. Found under discarded wooden pallet. **Occasional**

Derocerus reticulatum (Müller) Field slug. Found under discarded pallet in orchard. **Occasional**

Trichia striolata (Pfeiffer) Strawberry snail. Prefers tall grasses and nettles. Found along margins of orchard. **Frequent**

Trichia hispida (L.) Hairy snail. A species of ground litter and herbage. Found in marginal grass and nettles sites of orchard. Avoids deeply shaded locations where the apple canopies are dense. **Frequent**

Monacha cantiana (Montagu) Kentish snail. This snail was introduced to Britain in late Roman times. Prefers tall grasses near margins of the orchard.

Occasional

Helix aspersa Müller Garden snail. In long grasses bordering margins of orchard. **Common**

Diatoms Parts of the ground were covered with mosses intermixed with grass. The washing from the moss were Dematiaceous Hyphomycetes spores and a single species of diatom *Hantzschia amphioxus.* **Abundant**

A NEW DIATOM RECORD FOR NORFOLK (Draft Text)

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The list of Norfolk diatoms exceeds 800 taxa and dates back, in part to 1876 so that it is unusual to meet an additional taxon. Examination of the moss from the White House Orchard on Walpole Highway, however, produced not only an addition but what may be a new taxon.

The moss, gathered from the ground under the apple trees was washed and the washings treated with nitric acid to remove as much organic matter as possible. The resulting diatom valves were mounted in Naphrax and counted. About 50% were *Hanzschia amphyioxus* and 50% were recorded as *Achnanthidium* sp.

Subsequent stubs were prepared and examined in the scanning electron microscope at the School of Environmental Sciences, University of East Anglia. Under the light microscope the most striking feature was the outline of the valve, being linear with a tendency to spatulate ends (figure 1). It appeared to be *Aahnanthidium didyma* Hustedt but measured 10.5 - 14.5µm long (against Hustedt's 6 - 8µm). It was 3 - 4µm broad at the widest part but 2µm at the narrowest part in the spathulate valves.
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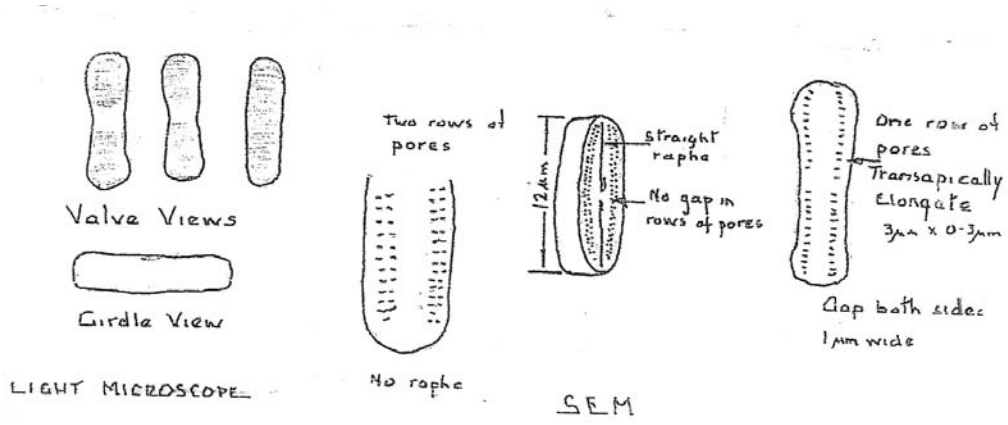
Running along the valves were two rows or four rows of pores. The pores were about 40 in 10µm (not 30-34), The pores were elongate in a transapical direction; about 0.3µm long and 0.03µm wide.

Our Walpole taxon does not bear much relation to *A.didyma*. The Walpole material is linear in girdle view.

In the valve view with the light microscope, it appears that there is a wide central area separating areas of very fine, indivisible striae. In the SEM it is evident that the striae are single or double pores and the central area is the absence of four groups of such pores. The gap is about one micron. In Hustedt's *A. didyma* the middle striae were more powerful. There was no gap.

It would appear therefore, that we are dealing with a new diatom new to Norfolk, and it may even be a taxon which has hitherto not been described.



GUNTON HALL: NORFOLK

Location Gunton Hall near Hanworth

Grid reference TG 231 341

History A walled orchard of approximately 1.5-2 acres dating from the mid to late 19th C. About 100 apple trees and 40 pear trees arranged in rows with grass sward between. The orchard is not chemically sprayed.

Survey The orchard is mown annually in the autumn and the pathways mown regularly. The grasses are rank with hogweed, goosegrass and bindweed. There is little leaf litter beneath the grass sward. Only a small number of dead logs noted in the orchard. The hand made brick walls and some rubble offered diverse snail/slug habitats. This orchard differs from some of the other apple orchards surveyed in having a managed understorey of vegetation. The aspect is very open and little shading by the tree canopies is evident. Shading by trees is not a critical factor in this walled orchard.

The soil is a sandy loam derived from the Cromer moraine.

Mollusca *Cochlicopa lubrica* (Müller) Slippery moss snail. A catholic species common in all types of damp, sheltered places. Noted in ground litter in orchard.
Common

Vallonia costata (Müller) Ribbed glass snail. A typical snail of short-turfed grass swards. **Occasional**

Arion hortensis Férussac. Garden slug. A known garden pest. Found under stones and rubble beneath walls. **Frequent**

Aegonpinella nitidula (Drap.) Smooth glass snail. In grass sward.
Occasional

Oxychilus draparnaudi (Beck) Draparnaud's glass snail. In grass sward. This species is thought to have been introduced to Britain in Roman times.

Occasional

Trichia hispida (L.) Hairy snail. A species of ground litter and herbage. Found in grass sward. Avoids deeply shaded locations where the apple canopies are dense.

Frequent

Vitrina crystallina (Müller) Crystal snail. In grass sward. **Occasional**

Cecilioides acicula (Müller) Blind snail. This is a blind, subterranean species occurring in soils to a depth of two metres. **Occasional**

Cepaea nemoralis (L.) Brown-lipped snail. In grass sward. **Common**

Helix aspersa Müller Garden snail. In long grasses bordering margins orchard. **Common**

Diatoms	**Moss on trees**	
	Pinnularia borealis	55%
	Hantzschia amphioxys	35%
	Melosira arenaria	8%
	Luticola mutica	25%
Diatoms	**Moss among raspberry canes**	
	Pinnularia borealis	14%
	Hantzschia amphioxys	41%
	Navicula cari	6%
	Achnanthes sp.	39%

Diatoms	**Epiphytic diatoms in tiny reservoir**	
	Fragillaria radians	78%
	Nitzschia palea	14%
	Achnathes sp.	4%
	Cocconeis placentula	3%

The diatom counted as *Achnanthes* sp. is to be examined in the Scanning Electron Microscope when this is available. Moss on the northern side of the enclosing brick walls contained no diatoms

YAXHAM: NORFOLK

Location 'Look East' Dereham Road, Yaxham, Dereham

Grid reference TG 005 106

History Disused apple orchard planted in 1919. The trees are now mature and grow to heights in excess of 20m. Over 50 different cultivars. The orchard has been unsprayed for decades.

Survey Most of the understorey is mown grass with buttercups. In a small area the orchard is unmanaged and is more overgrown. There are stands of mosses and liverworts covering some of the soil. There is little leaf litter. Fallen branches are few such that rotting logs are not a feature of this orchard. The overall picture is of a habitat offering limited ecological factors for snails and slugs. However, the fruit does provide a ready supply of food for the slug species. The field slug *Derocercus reticulum* was abundant in the topsoil beneath the trees

The soil is friable.

Mollusca *Cochlicopa lubrica* (Müller) Slippery moss snail. A catholic species common in all types of damp, sheltered places. Noted in ground litter in orchard. **Common**

Discus rotundatus (Müller**)** Radiated snail. Typical of a wide range of habitats. Mostly noted in litter and under bark of fallen branches in unmanaged section of orchard. **Occasional**

Oxychilus draparnaudi (Beck) Draparnaud's glass snail. In grass litter. **Occasional**

Oxychilus allairius (Miller) Garlic snail. In litter and under bark of rotting branches in unmanaged section of orchard. Likes moist habitats. **Occasional**

Derocercus reticulatum (Müller) Field slug. In friable soil beneath buttercup/grass sward. **Abundant**

Arion hortensis Férussac. Garden slug. Typical of this type of habitat. **Occasional-frequent**

Boettgerilla pallens Simroth. Worm slug. First noted in UK in1972. It has spread rapidly throughout the country. Prefers damp places such as the unmanaged section of this orchard. It is a south-east European slug which is partially subterranean. It is normally associated with gardens and parks, although it is now spreading into natural habitats. **Rare**

Trichia striolata (Pfeiffer) Strawberry snail. Amongst nettles. **Frequent**

Cepaea nemoralis (L.) Brown-lipped snail. In grass sward. **Common**

Diatoms Occasional trees in this orchard had growth of moss, usually in the lowest fork of the trees or on the trunk. Finds were the diatom *Pinnularia borealis* and a bdelloid rotifer of the same species found at Burnham.

BURNHAM THORPE : NORFOLK

Location Leith Farm Orchard, Burnham Thorpe.

Grid reference TG 865 426

History A commercial plum orchard dating from the 1970s. Some apple trees also included. The plum trees are sprayed to destroy aphids before the plums have formed. Aphids carry a harmful virus. Pheromone trays are used to monitor for plum moth and if necessary the trees are sprayed.

Survey The orchard pathways are mown regularly to produce a close grass sward with creeping buttercups. Between the trees the grasses are rank and these are normally cut in the autumn when picking has ceased for the season. The trees are in open rows and thus cast little dense shade. Any fallen or fungal infected branches are cut off and burnt so rotting timber is not a feature of this commercial orchard.

The soil is fairly heavy with a high proportion of clay. This is good for moisture retention but bad for drainage.

Mollusca *Cochlicopa lubrica* (Müller) Slippery moss snail. A catholic species common in all types of damp, sheltered places. Noted in grass litter in orchard. **Common**

Discus rotundatus (Müller**)** Radiated snail. Typical of a wide range of habitats. In grass sward litter. **Frequent**

Columella edentula (Draparnaud). Toothless chrysalis snail. In grass litter between trees **Occasional**

Vallonia excentica Sterki. Excentric glass snail. A typical snail of short-turfed open grass swards. Usually found in gardens and nurseries. **Occasional**

Punctum pygmaeum (Draparnaud) Dwarf snail. This species can live in habitats heavily disturbed by man. In grass litter. **Abundant**

Oxychilus alliarius (Miller) Garlic snail. In grass sward. **Occasional**

Nesovitrea hammonis (Ström.) Rayed glass snail. Common in vegetation and litter in a wide range of habitats. Found in orchard litter. **Occasional**

Vitrina pellucida (Müller) Pellucid glass snail. In grass sward. **Occasional**

Derocerus reticulatum (Müller) Field slug. In topsoil and attacking fallen plums. **Occasional**

Helix aspersa Müller Garden snail. In long grasses bordering margins of orchard. **Common**

Diatoms There were two moss localities within the two orchards. Close to the trees the grass had been mown and moss had developed there. In only a few places did moss grow on the lower trunks of the trees. On the grass in both orchards there were occasional finds of the diatoms *Hantzschia amphioxys* and *Pinnularia borealis*. In the east orchard there was a bdelloid rotifer.

Table 1. Showing distribution of molluscs in five Norfolk orchards

Species	Aldeby	Walpole	Gunton	Yaxham	Burnham
Cochlicopa lubrica	+	+	+	+	+
Vallonia costata			+		
Vallonia excentrica					+
Discus rotundatus	+			+	+
Punctum pygmaeum					+
Arion ater		+			
Arion hortensis	+	+	+		
Derocercus reticulum		+		+	+
Boettgerilla pallens				+	
Vitrea crystallina	+		+		
Nesovitrea hammonis	+				+
Vitrina pellucida				+	+
Aeogopinella pura	+				
Aegopinella nitidula	+	+	+		
Oxychilus draparnaudi		+	+	+	
Oxychilis alliarius				+	+
Cecilioides acicula			+		
Cochlodina laminata	+				
Clausillia bidentata	+				
Columella edentula					+
Trichia striolata	+	+		+	+
Trichia hispida		+	+		
Monacha cantiana		+			
Arianta arbustorum	+				
Cepaea hortensis	+				
Cepaea nemoralis			+	+	
Helix aspersa		+	+		+
Total	**12**	**10**	**10**	**9**	**11**

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