

## Phenology of UK Plants Orchids and Zooniverse

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***Agrimonia eupatoria***

# Robbirt & al. 2011 and UK specimens of *Ophrys sphegodes* Mill

## Journal of Ecology

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### Validation of biological collections as a source of phenological data for use in climate change studies: a case study with the orchid *Ophrys sphegodes*

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#### Summary

1. The scarcity of reliable long-term phenological data has severely hindered the study of the responses of species to climate change. Biological collections in herbaria and museums are potential sources of long-term data for such study, but their use for this purpose needs independent validation. Here we report a rigorous test of the validity of using herbarium specimens for phenological studies, by comparing relationships between climate and time of peak flowering derived from herbarium records and from direct field-based observations, for the terrestrial orchid *Ophrys sphegodes*.

2. We examined herbarium specimens of *O. sphegodes* collected between 1848 and 1958, and recorded peak flowering time directly in one population of *O. sphegodes* between 1975 and 2006. The response of flowering time to variation in mean spring temperature (March–May) was virtually identical in both sets of data, even though they covered different periods of time which differ in extent of anthropogenic temperature change. In both cases flowering was advanced by c. 6 days per °C rise in average spring temperature.

3. The proportion of variation in flowering time explained by spring temperature was lower in the herbarium record than in direct field observations. It is likely that some of the additional variation was due to geographical variation in collection site, as flowering was significantly earlier at more westerly sites, which have had warmer springs, over their range of 3.44° of longitude.

4. Predictions of peak flowering time based on the herbarium data corresponded closely with observed peak flowering times in the field, indicating that flowering response to temperature had not altered between the two separate periods over which the herbarium and field data were collected.

5. **Synthesis.** These results provide the first direct validation of the use of herbarium collections to examine the relationships between phenology and climate when field-based observational data are not available.

**Key-words:** biological collections, climate change, flowering time, herbarium specimens, natural history collections, *Ophrys sphegodes*, Orchidaceae, phenology, spring, temperature

#### Introduction

Phenological events respond directly to climate. Recent climate change has undoubtedly affected the timing of development and seasonal events in many groups of organisms, including amphibians (Beebe 1995), birds (Crick *et al.* 1997), fungi (Kauersud *et al.* 2008) and plants (Spurks & Carey

1995; Fitter & Fitter 2002). Understanding the effects of recent climate change is a vital step towards predicting the consequences of future change. Moreover, only by elucidating the responses of individual species will we be able to predict the potentially disruptive effects of accelerating climate change on species interactions.

Detecting phenological trends in relation to long-term climate change is not straightforward. Because trends can be concealed by short-term inter-annual climate variation

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# NHM Origins and Evolution Initiative: UK Phenology Project

- 20,000 herbarium sheets imaged and transcribed
- Volunteer contributed taxonomic revision, morphometric and plant/insect pollinator data compiled
- Extension of volunteer work to extract additional phenology data from other UK museums and botanic gardens
- 7,000 herbarium sheets curated and mounted
- Collaboration with BSBI/Herbaria@Home
- Preliminary analyses of orchid phenology underway

**Robbirt & al.** (2011) . Validation of biological collections as a source of phenological data for use in climate change studies: a case study with the orchid *Ophrys sphegodes*. *J. Ecol.*

**Brooks, Self, Toloni & Sparks** (2014). Natural history museum collections provide information on phenological change in British butterflies since the late-nineteenth century. *Int. J. Biometeorol.*

**Johnson & al.** (2011) Climate Change and Biosphere Response: Unlocking the Collections Vault. *Bioscience*.



Specimens of *Gymnadenia conopsea* (L.) R.Br



# Orchid Observers

Phenology of UK Plants  
Orchids and Zooniverse

Mark Spencer & Kath Castillo  
Department of Life Sciences  
Natural History Museum

**ZOONIVERSE**



Arts & Humanities  
Research Council



# 56 species of wild orchid in the UK

## 29 taxa selected for this study

*Anacamptis morio*

*Anacamptis pyramidalis*

*Cephalanthera damasonium*

*Coeloglossum viride*

*Corallorhiza trifida*

*Dactylorhiza fuchsii*

*Dactylorhiza incarnata*

*Dactylorhiza maculata*

*Dactylorhiza praetermissa*

*Dactylorhiza purpurella*

*Epipactis palustris*

*Goodyera repens*

*Gymnadenia borealis*

*Gymnadenia conopsea*

*Gymnadenia densiflora*

*Hammarbya paludosa*

*Herminium monorchis*

*Neotinea ustulata*

*Neottia cordata*

*Neottia nidus-avis*

*Neottia ovata*

*Ophrys apifera*

*Ophrys insectifera*

*Orchis anthropophora*

*Orchis mascula*

*Platanthera bifolia*

*Platanthera chlorantha*

*Pseudorchis albida*

*Spiranthes spiralis*





Fly orchid (*Ophrys insectifera*)

Participants:

**1. Online – classification**

Classify museum specimens

**2. In the field – gathering new data**

Find and photograph orchids in flower

**3. Online – classification**

Classify field images

# ZOONIVERSE

We make citizen science websites so that everyone can be part of real research online

daily.zooniverse.org

Something awesome from the Zooniverse every day

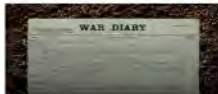
## Humanities



### Study the lives of ancient Greeks

The data gathered by Ancient Lives helps scholars study the Oxyrhynchus collection.

ANCIENT LIVES



### Explore soldiers' diaries from the First World War

Annotate and tag diaries from the First World War.

OPERATION WAR DIARY



### Uncover the history of citizen science

Help us to classify their drawings and map the origins of citizen science.

SCIENCE GOSSIP

## Nature



### Help explore the ocean floor

The HabCam team and the Woods Hole Oceanographic Institution need your help!



### You're hot on the trail of bats!

Help scientists characterise bat calls recorded by citizen scientists.



### Go wild in the Serengeti!

We need your help to classify all the different animals caught in millions of camera trap images.



### Take Notes from Nature

Transcribe museum records to take notes from nature, contribute to science.

## Space

[Radio Galaxy Zoo](#)

[Disk Detective](#)

[Planet Hunters](#)

[Galaxy Zoo](#)

[The Milky Way Project](#)

[Planet Four](#)

## Natural World

[Snapshot Serengeti](#)

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[Penguin Watch](#)

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[Condor Watch](#)

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[Old Weather](#)

[Operation War Diary](#)

[Notes from Nature](#)

[Ancient Lives](#)

## Biology & Physics

[Worm Watch Lab](#)

[Cell Slider](#)

**The Zooniverse** is a collection of web-based citizen science projects that use the efforts and ability of volunteers to help scientists and researchers deal with the flood of data that confronts them.

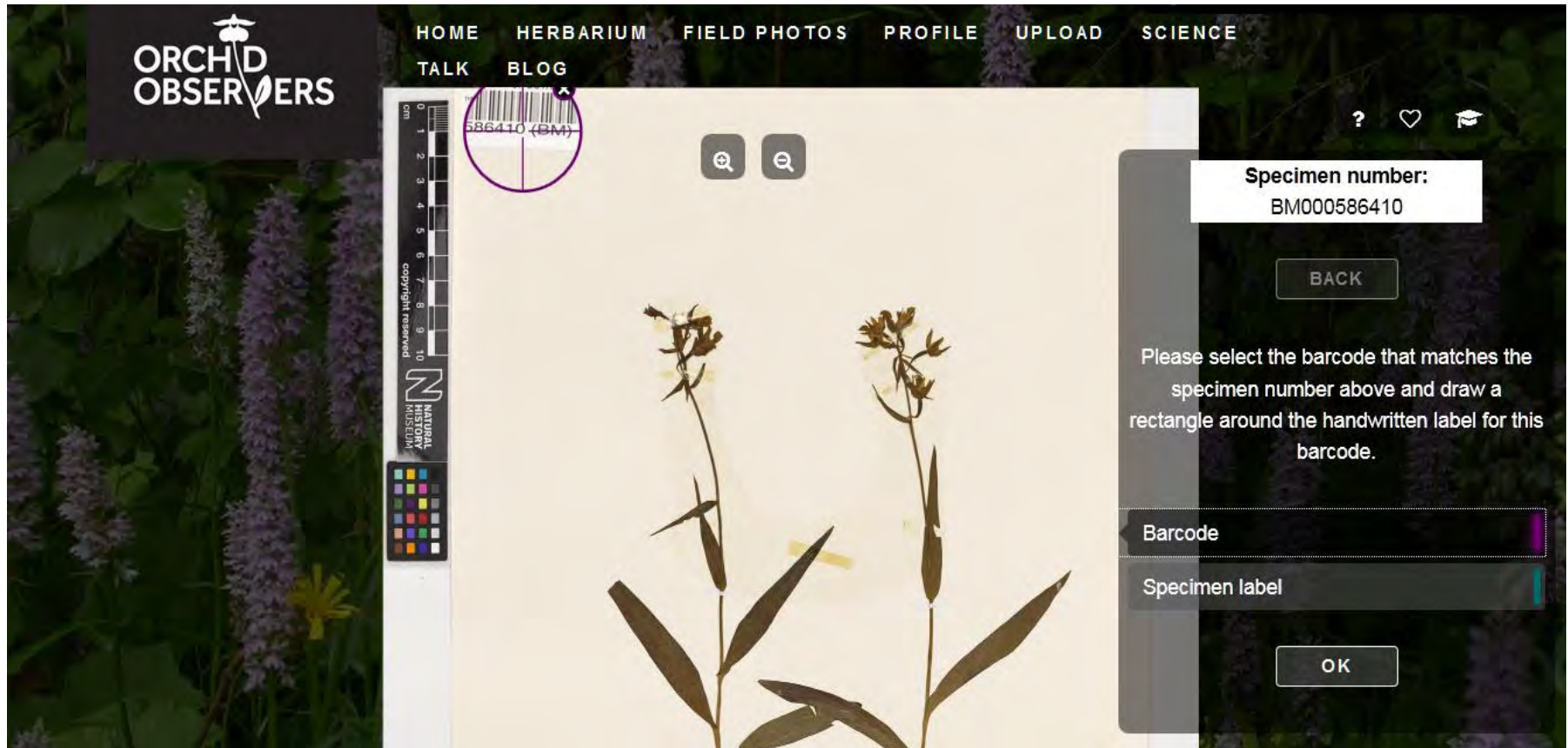
1,312,121 people taking part worldwide

[HOME](#)[HERBARIUM](#)[FIELD PHOTOS](#)[PROFILE](#)[UPLOAD](#)[SCIENCE](#)[TALK](#)[BLOG](#)[A Zooniverse project](#)[SIGN UP](#) | [SIGN IN](#)

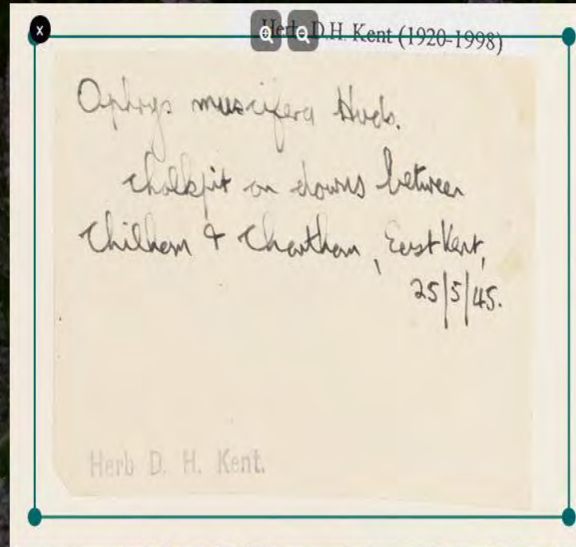
# Is climate change affecting the UK's orchids?

Photograph wild orchids this summer and annotate museum specimens to contribute to climate change research at the Natural History Museum. Gathering new photographs of UK orchids and extracting data on flowering times from over 10,000 Museum specimens is a huge task, so we need your help. Get involved here!

[Herbarium](#)[Field photos](#)[Upload photos](#)



- Over 10,000 digitised herbarium sheets



Specimen number:  
BM000568417

BACK

Verify the written specimen label

Species

Ophrys insectifera L.

Date

25/05/1945

Locality

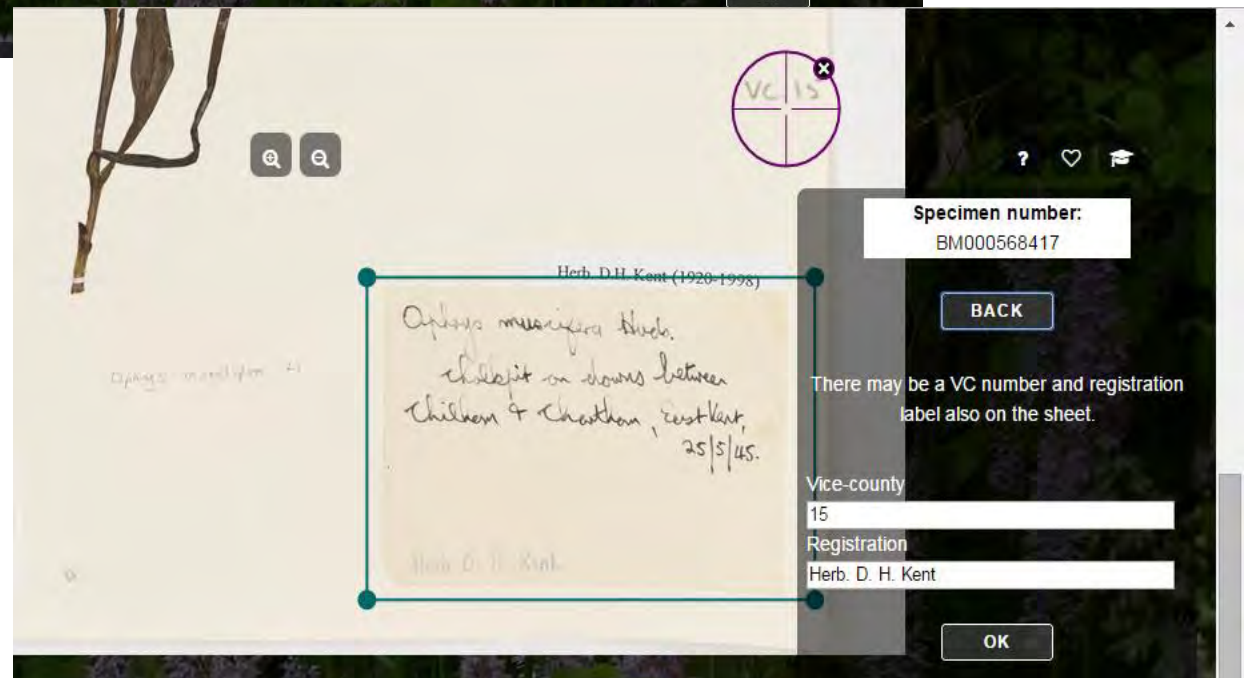
Downs between Chilham and Chatham

Label comments


Habitat: chalkpit

OK


# Herbarium







# Herbarium




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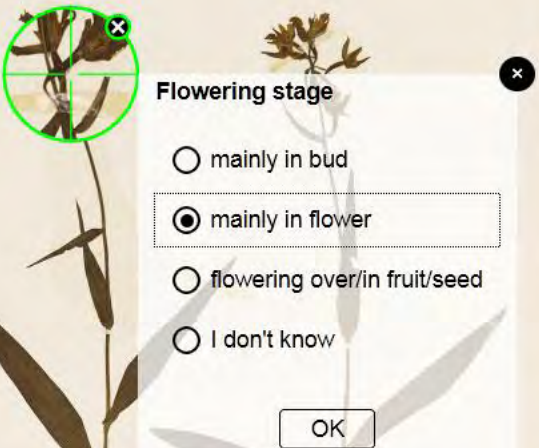




0 1 2 3 4 5 6 7 8 9 10  
cm  
copyright reserved  
NATURAL HISTORY MUSEUM



THE NATURAL HISTORY MUSEUM, LONDON  
DEPARTMENT OF BOTANY  
BOTANICAL HERBARIUM  
BM000586410



**Flowering stage**

☐ mainly in bud

☒ mainly in flower

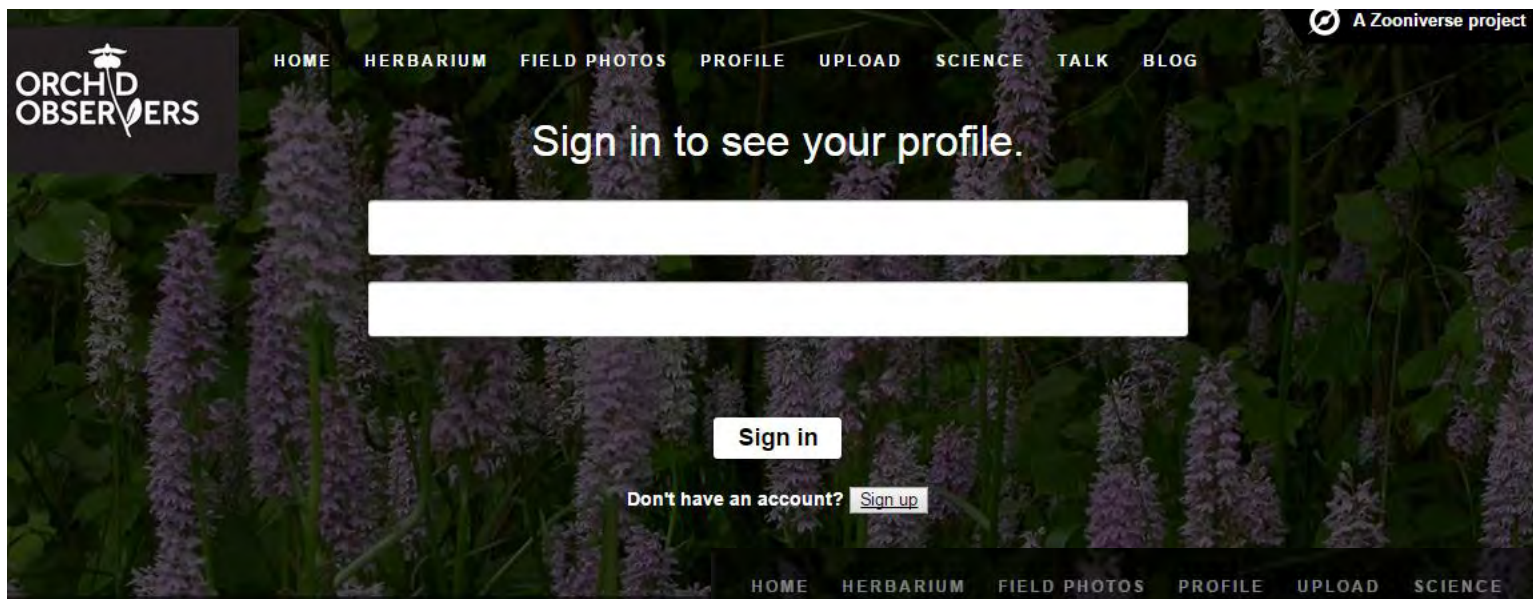
☐ flowering over/in fruit/seed

☐ I don't know

**Specimen number:**  
BM000586410

Finally, please select one of the specimens and estimate its flowering stage. If there is more than one barcode on the sheet, select a specimen close to the barcode that you marked.

**Flowering stage**



- Sign up on the website to upload photos

The same account will get you into all Zooniverse projects

A screenshot of the Zooniverse sign-up form. The form is titled 'Sign up for a new Zooniverse account'. It has a close button (X) in the top right corner. The form contains the following fields: Username, Password, Email, and Real name. Below the Real name field, there is a note: 'This will be used when we thank contributors, for example, in talks or on posters. If you don't want to be mentioned publicly, leave this blank.' There are two checkboxes: 'I agree to the privacy policy.' and 'I would like to receive notices with opportunities to test and provide feedback on unreleased Zooniverse projects.' At the bottom right of the form is a 'Sign up' button.

# Upload

preview.zooniverse.org/orchids/?api=https://dev.zooniverse.org#/upload

ORCHID OBSERVERS

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FORM RESOURCES

kathcas79 SIGN OUT

## Upload

### Enter orchid record

About You Which species and when? Where was it?

First name: kath

Surname: Castillo

Email: k.castillo@nhm.ac.uk

Zooniverse username:

Next step >

- Create field record and upload photographs

## Upload

### Enter orchid record

About You

Which species and when?

Where was it?

Date:

07/04/2015

Species:

Early-purple Orchid (*Orchis masculula*)

Certainty:

Please select  
Autumn Lady's-tresses (*Spiranthes spiralis*)  
Bee Orchid (*Ophrys apifera*)  
Bird's-nest Orchid (*Neottia nidus-avis*)  
Bog Orchid (*Hammarbya paludosa*)  
Burnt Orchid (*Neotinea ustulata*)  
Common Spotted-orchid (*Dactylorhiza fuchsii*)  
Common Twayblade (*Neottia ovata*)  
Coralroot Orchid (*Corallorhiza trifida*)  
Creeping Lady's-tresses (*Goodyera repens*)  
**Early-purple Orchid (*Orchis masculula*)**  
Early Marsh-orchid (*Dactylorhiza incarnata*)  
Fly Orchid (*Ophrys insectifera*)  
Fragrant Orchid (*Gymnadenia conopsea*)  
Frog Orchid (*Coeloglossum viride*)  
Greater Butterfly-orchid (*Platanthera chlorantha*)  
Green-winged Orchid (*Anacamptis morio*)  
Heath Fragrant-orchid (*Gymnadenia borealis*)  
Heath Spotted-orchid (*Dactylorhiza maculata*)  
Lesser Butterfly-orchid (*Platanthera bifolia*)

Photos

Add photo

Next step >

## Upload

## Upload

### Enter orchid record

About You

Which species and when?

Where was it?

Date:

07/04/2015

Species:

Early-purple Orchid (*Orchis masculula*)

Certainty:

Certain

Photos

Add photo

Use the Add file button to select a file from your local disk. Files of type jpg, gif, png, jpeg are allowed.

< Prev step

Next step >

- Record date photographed
- Record species - select from drop down list of the 29 orchid taxa

Orchid Observers x

preview.zooniverse.org/orchids/?api=https://dev.zooniverse.org/#/upload

✓ Thank you for submitting your data.

## Enter orchid record

About You Which species and when? Where was it?

Date: 06/04/2015


Species: Early Marsh-orchid (*Dactylorhiza incarnata*)

Certainty: Certain

Photos

Add photo

file



Caption: D. incarnata

< Prev step Next step >

- Add photo (up to 4 per record)

Orchid Observers x

← → ↻ preview.zooniverse.org/orchids/?api=https://dev.zooniverse.org#/upload ☆ ☰

✓ Thank you for submitting your data.

## Enter orchid record

About You Which species and when? Where was it?

**Site name:**  
 🔒


**Location comments:**

**Enter a spatial reference:**  
 🔒 +

**Or search for a place on the map:**

**Or simply click on your rough position on the map.**

Good. 100m square selected.



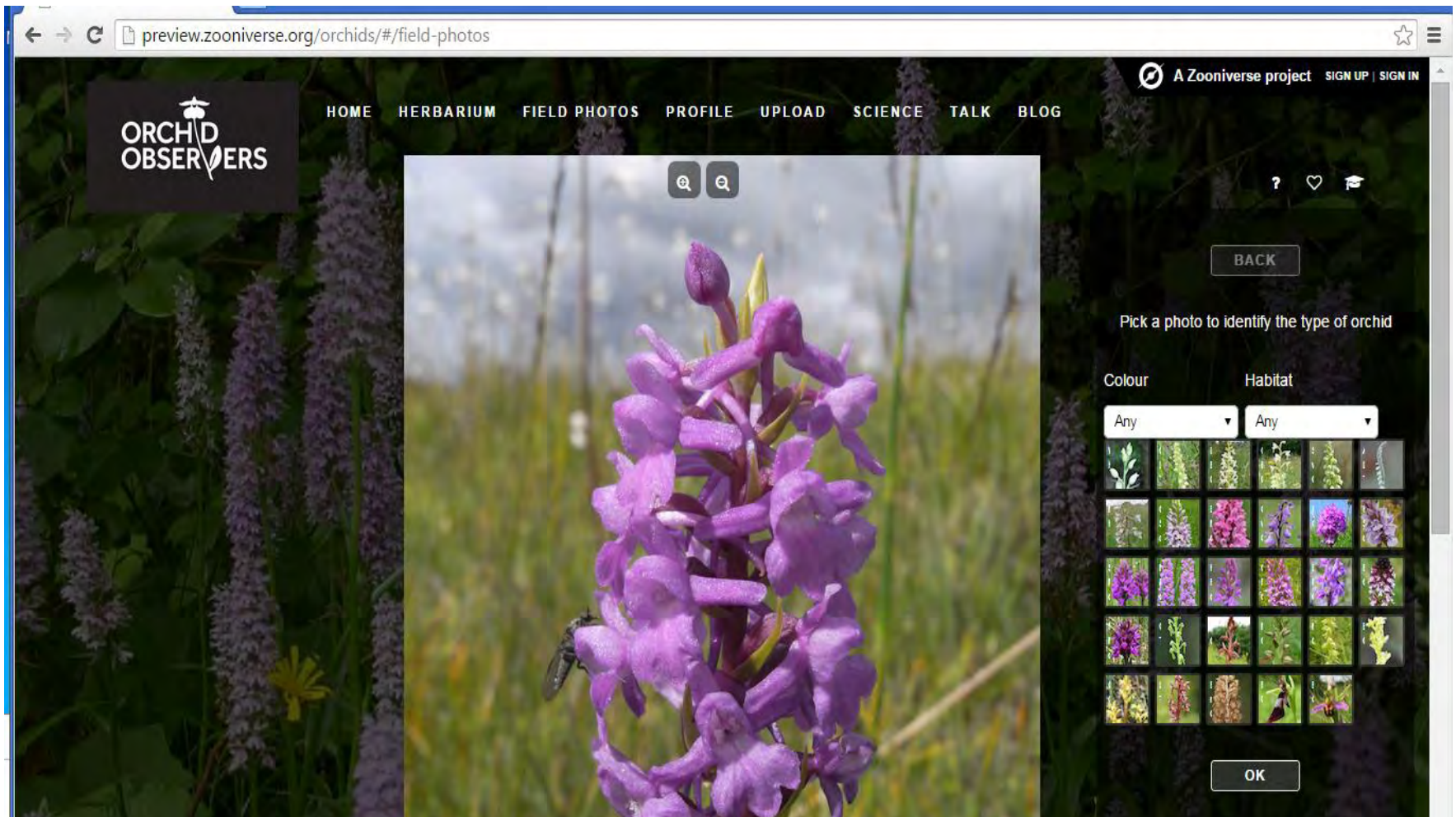
Google Map Data Terms of Use Report a map error

Click to set map ref 100m: TQ021988Jm: TQ021266 TQ0212998874 (hold -) (hold +)

< Prev step Save

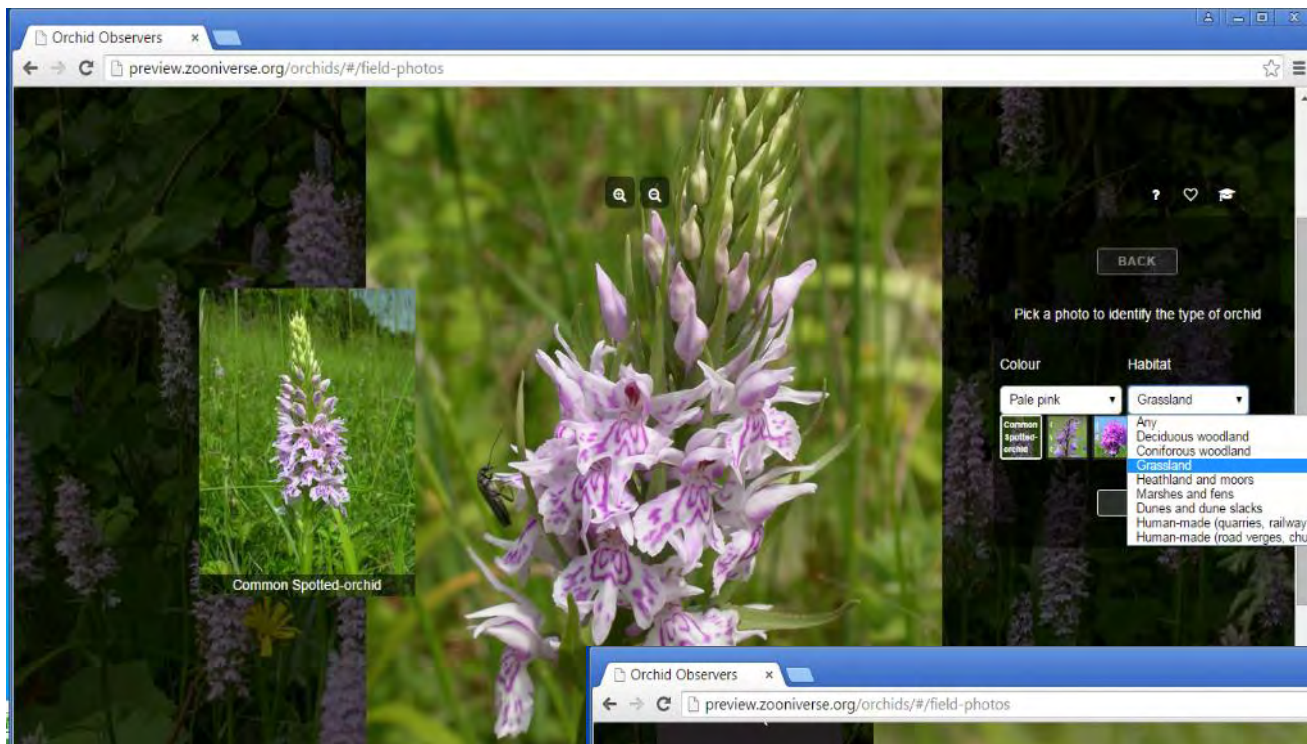
- Enter location and a spatial reference

## Field Photos

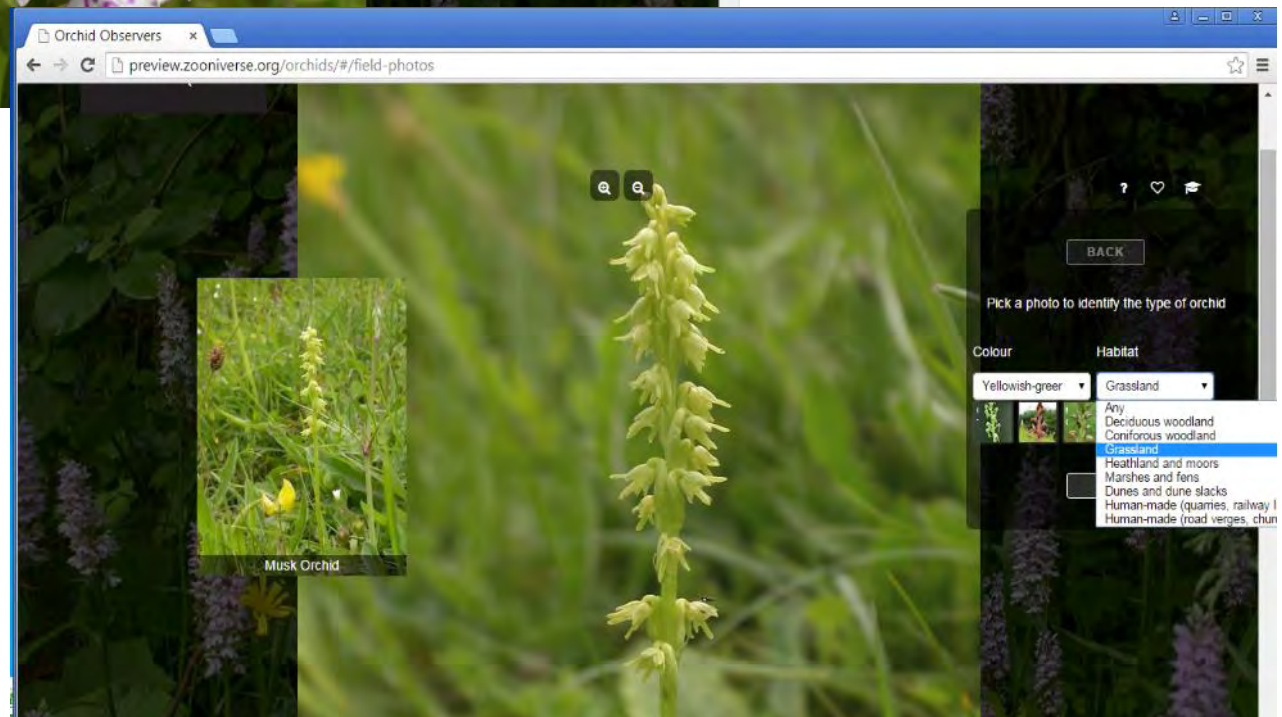


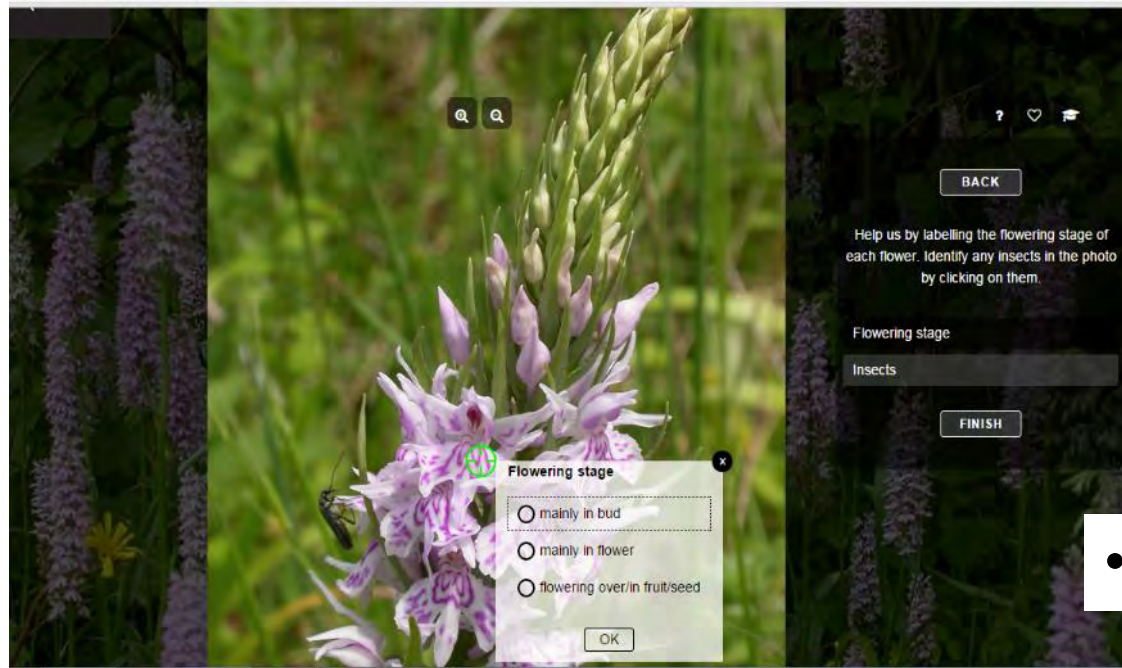
- classify species

## Field Photos



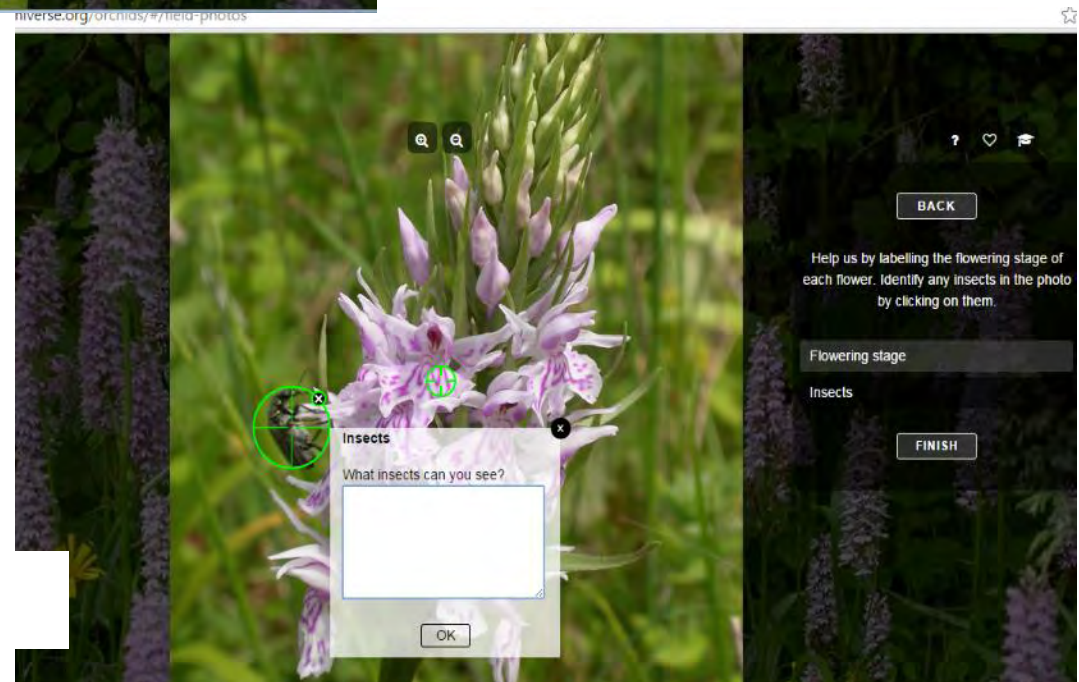
- classify species





## Field Photos

- Estimate flowering stage



- Identify any insects



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SCIENTIFIC  
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[www.orchidobservers.org](http://www.orchidobservers.org)

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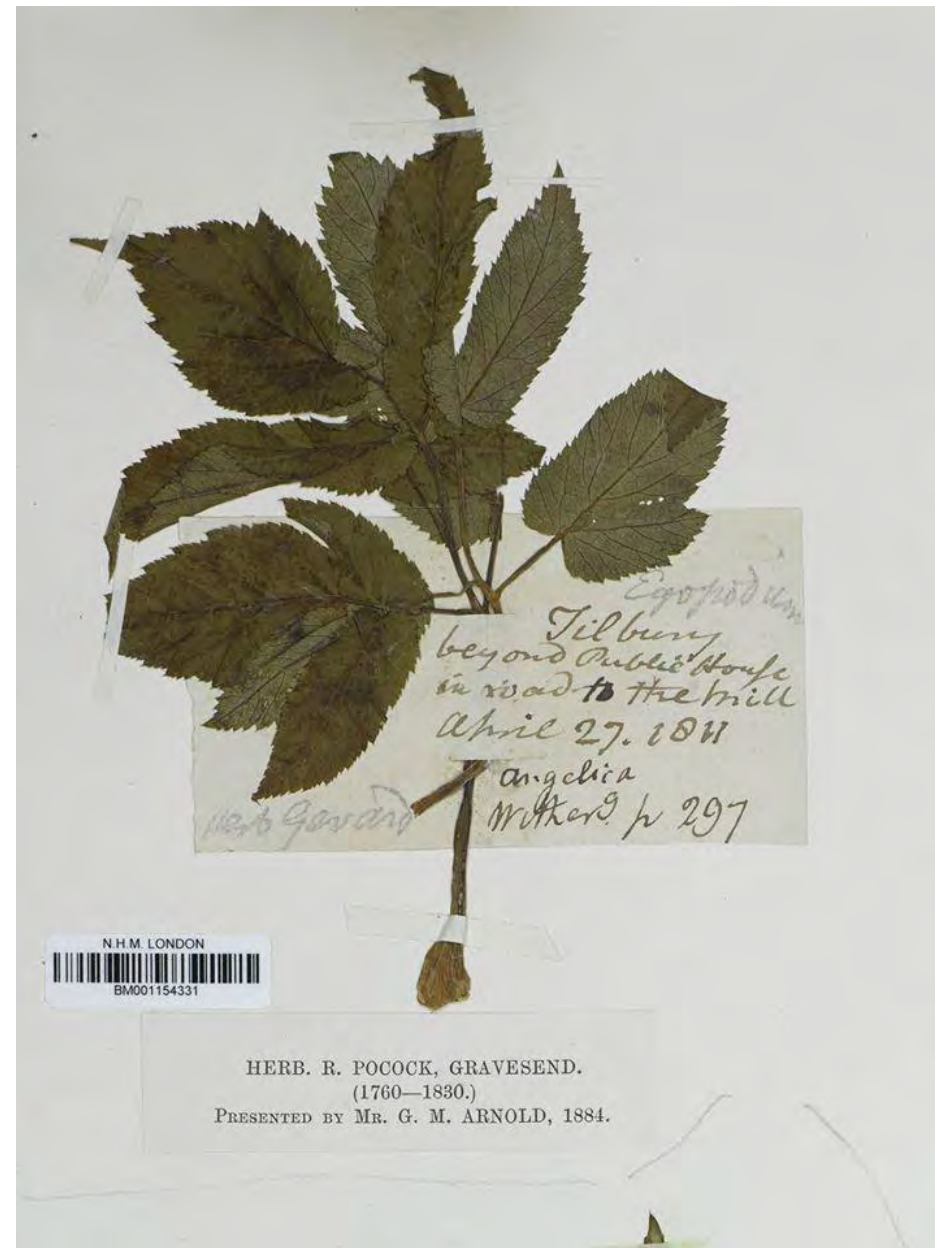


NATURAL  
HISTORY  
MUSEUM

# Robert Pocock Herbarium Project

- Community lead project discovering the botany and history of their town through the life of Robert Pocock and his herbarium.
- NHM staff providing access to collections, training on how to handle collections and database specimens

“On Tuesday we went to the Natural History Museum in London to collect the final set of scans of the Robert Pocock herbarium specimens. ....So what's special about this specimen of ground-elder? It was the last one to be found and the total now stands at 220.....As if often the case Pocock gives us the exact location of where and when he found the plant. I will probably get the ferry across the Thames and go and look for the plant myself!” – *Malcolm Jennings (project lead) 6<sup>th</sup> November 2014*



**Specimen of ground-elder – *Aegopodium podagraria*.** Collected by Robert Pocock

*‘Tilbury, beyond Public House in road to the Mill. April 27 1811’.*