An investigation into the flowering period of oak within planted and natural woodlands and the relationship with the presence of the bee *Andrena ferox* (Hymenoptera : Apidae)

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Cover photograph:
Andrena ferox female by Mike Edwards

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1. Background

1.1 Survey Aims

It is possible that populations of the mining bee *Andrena ferox* are limited, within a suitable temperature envelope, by the availability of a succession of oak trees flowering. Such a situation could arise in areas where the majority of oak woodland is of a plantation nature, rather than a naturally regenerated one. Selection of oaks for growth forms more suited to plank production (apart from the influence of immediate growing conditions) could have reduced the genetic variability giving rise to a succession of flowering period in naturally regenerating woodland, such as the New Forest.

Flowering times are directly related to timing of leaf-bud, the flower tassels emerging before the leaves open. Timing of bud-burst is known to be under control of genetic factors, the relative frequency of these being influenced by both late frosts and by attacks by defoliating caterpillars but existing in an overall equilibrium in a natural, seed- regenerated population.

This investigation set out to look at the timing of flower production in mature plantation woodland in West Sussex, where no records of *A. ferox* exist, and in mature natural woodland in the New Forest, where a population of *A. ferox* exists.

1.2 Previous Work

Andrena ferox is a communally nesting species with three known discrete modern populations (Surrey, Reigate; Kent, Pluckley and Hampshire, New Forest). A further population was recorded in East Sussex (Polegate) in the 1940s, but although the locality is quite well described, efforts to re-locate it here have not been successful. It was placed on the initial Biodiversity Action Plan list, but, apart from rediscovering the species in known areas, very little extra autecological information has been gained since then. This is largely because the opportunities to study this species directly are very limited.

The bee is known to have a strong relationship with Oak *Quercus* sp. flowers, where it collects its pollen. Individual oak trees produce pollen for a very restricted period of less than a week. As female bees are thought to require about a two week period in which to collect sufficient pollen to provision a suitable number of cells to provide the next generation, it follows that a single tree will not provide a sufficient resource.

Whilst flowering, each oak tree will produce vastly more pollen, albeit for a short period, than required by an individual female. This means that a succession of flowering trees is an essential requirement, rather than just lots of trees, but also gives the potential to support a large local population.

Oak flowers do not produce nectar, so an alternative flower resource is also required in order to provide the bee with nectar. During these and other investigations bees, both male and female, have been seen foraging at Field Maple *Acer campestre* and Hawthorn *Crataegus* sp. flowers (see previous Hymettus/ACG Reports).

The bees at these flowers have not been seen to collect pollen. However, Paul Westrich (1989, Die Wildbeenen Baden-Würtemburgs) notes pollen as having been collected from Field Maple and Hawthorn. R. Leys (1978, On the Biology of *Andrena ferox* Smith (Hymenoptera, Aculeata, Apidae)) only reports pollen collection from Oak, as does S. Roberts (analysis from one female, pers. com.).

2. Methods

2.1 Site selection

Four samples were taken in West Sussex and four in the New Forest.

The sample sites selected in West Sussex where *A. ferox* was unknown were:

- Oakreeds Wood (SU877291).
- Newlands Copse (SU876296) (itself a subject of detailed survey for the Cowdray Estate in 2002 when a good old woodland fauna and flora was recorded).
- s. of Woodmans Green (SU864271).
- s. of Cocking Causeway (SU881188).

The sample sites selected in the New Forest where *A. ferox* was known were:

- Hollands Wood camp site (SU304044) (2 samples).
- Denny Wood (SU334058) (2 samples).

2.2 Survey methods

Each sample consisted of 30 mature trees along a line walked at approximately one-week intervals between 24/5/2008 and 12/5/2008. Three visits were made to each sample site.
Along each line the condition of the canopy (not the lowest branches) of each tree, as seen through binoculars, was classified according to five categories:

- in bud;
- just in leaf (bud showing burst);
- green flower tassels abundant;
- flowers open (yellow pollen obvious);
- flowers finished (brown and withered).

At Hollands Wood the numbers of females leaving and arriving at the nesting aggregation by the tree stump were recorded over three 20 minute periods on 12/5/2008.

Some exploration of other areas within the New Forest for *A. ferox* was undertaken. The sites visited were:

- Ranmore Enclosure (SU3104);
- Boulderwood (SU247072);
- Mark Ash (SU244077);
- South Bentley Enclosure (SU2312).

3. Results

3.1 Oak flowering period

The results from the investigation are presented as table 1. From this it is clear that extent of flowering time is not a major difference between the two sets of woodland samples and cannot thus explain the presence or absence of *A. ferox* in these areas.

3.2 Movements of females at nest site

Two entrances to large nesting aggregations were found at Hollands Wood (by tree stump and by side of toilet block). Both had been recorded on previous survey visits for ACG/Hymettus. Returning females always had bright yellow-green pollen loads. This was most likely Oak pollen. Samples of pollen loads were retained for later analysis. All females took off and headed towards the tree-tops, returning on a similar flight-path.

The numbers of females leaving and arriving at the nesting aggregation by the tree stump are shown in Table 2. Mark and recapture of females would allow foraging and underground provisioning times to be established as well as an index of the numbers of females present.

Table 2: Numbers of females of *A. ferox* leaving and entering nest site by tree stump, Hollands Wood, 12/5/2008.

Timing Period	Out	In
1	33	53
2	28	29
3	30	40

3.3 Survey of other sites in New Forest

No A. ferox were found at any of the four sites visited.

3.4 Other observations

A. ferox males (predominately) and females (very occasionally) were seen visiting Field Maple (mostly) and Hawthorn at Denny Wood. This is the converse of the situation at this locality reported for other years by George Else (pers comm.). No visits to other flowering plants were recorded at Hollands Wood.

	site 1 SU877291	Site 2 SU876296	Site 3 SU864271	Site 4 SU881188		Site 5 SU304044	Site 6 SU304044	Site 7 SU334058	Site 8 SU334058
date: 24/4/08					**date: 28/4/2008**				
in bud	8	19	13	9		2	3	2	2
just in leaf	11	7	13	8		8	5	3	7
green flower tassels abundant	11	4	4	13		11	13	10	12
flowers open						9	9	15	9
Total	30	30	30	30		30	30	30	30
date: 2/5/2008									
in bud	1	0	4	0	**date: 6/5/2008**	0	1	0	0
just in leaf	8	1	5	1		1	0	0	0
green flower tassels abundant	2	12	9	4		3	3	2	3
flowers open	15	17	12	20		16	21	9	8
flowers finished	4	0	0	5		10	5	19	19
Total	30	30	30	30		30	30	30	30
date: 8/5/2008					**date: 12/5/2008**				
in bud	0	0	0	0		0	0	0	0
just in leaf	0	1	0	0		0	0	0	0
green flower tassels abundant	0	2	0	3		0	0	0	0
flowers open	16	14	18	15		5	4	13	11
flowers finished	14	13	12	12		25	26	17	19
Total	30	30	30	30		30	30	30	30

Table 1: Results of sample counts of flowering oak trees in different woodlands between 24/5/2008 and 12/5/2008

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