A pollen analytical study of faeces from wiegon, *Anas penelope*. A case study.

by

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Abstract

Pollen analysis of faeces from bird (also mammals (King 1977)) gives important additional information about attractive and nutrient rich plant fodder hardly traceable using macro analysis or by field observation (e.g. Kaasa 1959, n.n 2009). Despite the *Anas penelope* case study is based on a minimum of samples, new nutrient rich taxa not recorded during field observation are found. References to broader studies are given.

Introduction

The supply of plant food during winter, spring, and early summer is of special importance for the birds in general (Owen 1973. 1978a,b, Reed 1976)

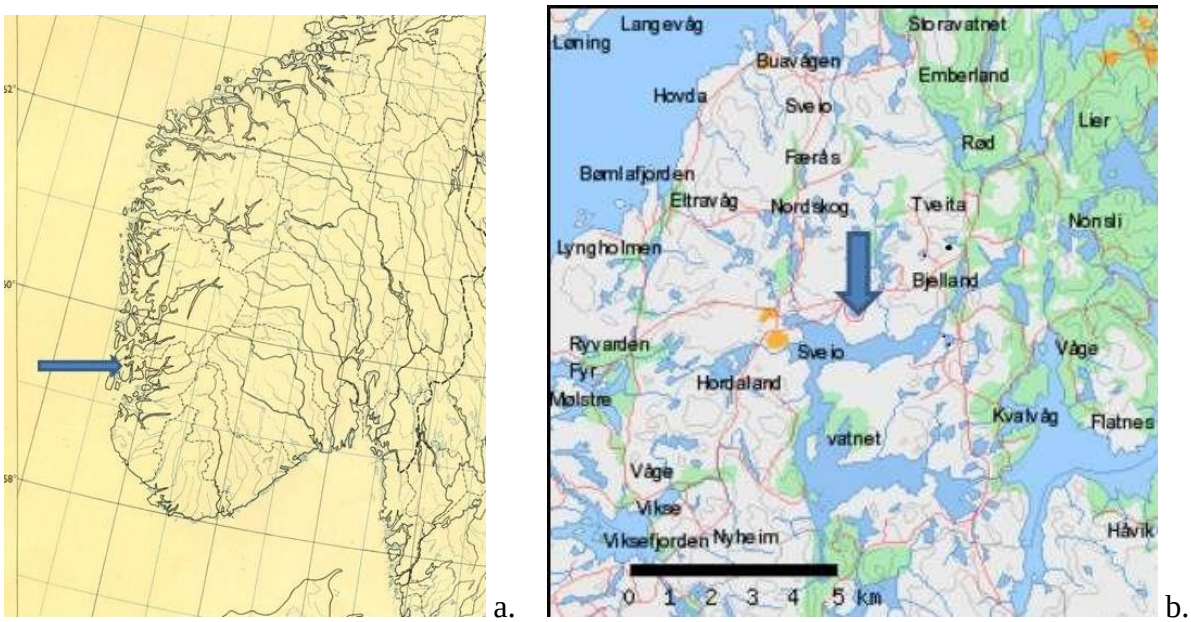
. Adaptive strategies of Eurasian Wiegon, (*A. penelope)* show that the birds used food from both terrestrial and lacustrine habitats from 9th April to 2nd June 1983 (Jacobsen 1986). For other birds more time consuming macro studies are made showing a change during springtime from for instance *Betula* catkins, available shoots and winter-green parts of different Ericales followed by different, mostly undefined herbs. The potential importance of pollen and flowers of herbs with nutrient-rich content, like nectar, has hardly with some exceptions, been discussed (Moe & Bjune 2009). The selective use of field observations and macro-remains studies seem to exclude important information about bird feeding. In the studied period the bird feed themselves on both on both terrestrial and submerged plants, in addition to for instance insects.

Figure 1. *Anas penelope*, female in front. (Photo: Katie Fuller) Wikipedia Comm.

In the present study pollen analysis is used as an additional test to the made studies of *Anas penelope* at the lake Mannavatnet, Sveio, county of Hordaland, south western Norway (Fig. 1). The results are discussed in relation to other used techniques and the time of sampling.

Geography

The shallow lake, Lake Mannavatn is placed close by the municipality centre Sveio (Sveio municipality, Hordaland County) in the coastal area of western Norway). A geographical description of the Lake Mannavatn (59^{o} 33'N and 5^{o} 21' E) is made by Jacobsen 1993 . The climatic situation is dominated by oceanic mild and humid conditions, with a mean January and July temperature (period 1961-90) of respectively between +4 and 0 ^{o}C and 12-16 ^{o}C (Aune 1993). The mean early precipitation (1961-90) was between 1500-2000 mm (Førland 1993). The lake became a part of a protected nature conservation area in 1995, because of the wildlife, especially of the large number of birds, especially rich during the winter and the breeding season. Counting of has taken place several years, and a large number of species are registered. The vegetation surrounding the lake are dominated by agricultural fields with among others herbs like *Poa pratensis, Ranunculus acris, R. flammula*, and also *Trifolium repens*, mainly pastures for domestic animals, and heath land (including *Calluna vulgaris, Juniperus communis)* in addition to an open deciduous woodland dominated by among others birch (*Betula pubescens)* and pine (*Pinus sylvestris)*. Planted stands of spruce (*Picea abies)* exist. Around the lake wetland exist with among others different willow species (*Salix* spp.), *Carex* species, *Eriophorum angustifolium* and wetter habitats with *Carex rostrata, Equisetum fluviatile*, and *Phragmites communis*. Detailed registration of the flora within the lake is not done, but close to the shore *Potamogeton natans, Nymphaea alba* and *Nuphar lutea* occur.



a. b.

Figure 2. a. Survey map of south Norway; b. location of the small Lake Mannavatn in the municipality of Sveio (Hordaland), southwestern Norway.

Material and methods

Pollen analysis is a well known technique, and has also been used on among others faeces, stomach contents or coprolite material, food incl. honey based products, etc (e.g. Tikomirov & Kuprianova 1954; Moe 1983; Justesen 1992; Moe & Bjune 2009; Moe & Oeggl 2013. With pollen analysis, pollen and spores can be identified to family and/or genus level,

in some cases also to species level (Fægri & Iversen 1989). The pollen analysis reflects qualitatively the pollen content of the food, catkins, buds, flowers, pollen attached to leaves and different kind of fodder, pollen in snow, water, mud, and what ever else what have been eaten. Results are known in for different animals, and indicate an individual selection of available food, and by other methods hardly traceable plant taxa.

The present analysis is based on faecal samples from Eurasian wiegon (*Anas penelope),* droppings collected by O. Jacobsen during the breeding season in 1983 (Jacobsen 1986, 1992, 1993; Jacobsen & Uglevik 1990, 1992). Four samples have been used: 27th April, 12th and 25th May, and 9th June, all 1983 and prepared using the described technique by Fægri & Iversen 1986, Moe 1983. A more complete study for Willow Grouse (*Lagopus lagopus lagopus* L.) are made comparing using plant macrofossils and pollen in faeces (Moe & Bjune 2009). The pollen analysis is presented in fig. 2.

Results and discussion

The bird has used both dry terrestrial habitats, including agricultural fields, in addition to the shore (wetland) vegetation, open water, and some emergent and floating hydrophytes in the lake (Jacobsen 1993, table 1). The results of the pollen analytical test mostly correspond with the visual observed used plants for food. High amount of pollen of *Pinus, Betula,* hazel (*Corylus)* and black alder (*Alnus glutinosa)* are found in the pellets during the spring month, April and May is suggested to be connected to either direct interest for ripe catkins (in this case perhaps *Betula*) as food, or floating pollen on the lake, especially for *Pinus,* even for days.

The relatively high values of these taxa also correspond with assumed natural wind dispersed pollen. It is not known if these birds systematically are looking for these nutrient rich fodder (Roulston & Cane 2000), or not. Two other questions are if the pollen only by chance is following the birds need for fresh water, and if the birds are able to digest and use energy rich content of pollen. It is known that about one-third of pollen grains of *Banksia* are excreted one to two hours after ingestion by the birds *Phylidonyris novaehollandiae*, zebra finches (*Poephila guttata*) and budgerigars (*Melopsittacus undulatus*), and had lost their protoplasmic contents. Most pollen passed through the digestive systems (stomach and in some cases also along the intestine) of these birds in 4-5 hours and up to 44% of grains were digested (Wooller et al. 1988). Similar studies for wiegon (*Anas Penelope)* are not known.

The values for willow (*Salix* spp.) in the sample from 27th April are higher than normally found in analyses. The amount of pollen in their flowers (in catkins) is less than for the above mention tree species which are wind pollinated, while *Salix* mostly are insect pollinated taxa. The amounts may indicate that the birds see the catkins as attractive fodder, after for instance they have fell down on the ground. Also the genus, Cow-wheat (*Melampyrum)* belongs to the insect pollinated group. All species within the genus is not more than 20-30 cm tall, and are easily reach by the wigeons.

The pollen spectre from 27th April also includes some fern spores (e.g. *Gymnocarpon dryopteris*), probably indicating use of last year leaves. Of more interest is the pollen of the insect pollinated Alternate-flower Water-milfoil (*Myriophyllum alterniflorum),* again a plant with some nectar, indicating that also this species may have been attractive as fodder for the Wiegon. The plant and also other species within the genus are water plant, where most of the plant, leaves etc. are submersed, whit only the small flowers above water table.

During the observation period some pondweed (*Potamogeton)* species, flowering above the water table, was observed eaten by the birds, but not found within the available pollen material.

In the two samples from 27th April and 12th May, some heather (*Calluna vulgaris*) and other related species are found, indicating either use of heat land habitat or also perhaps use of

general food at the ground containing pollen from heat land habitats. These two samples also contain grass pollen (Poaceae) and some sedge pollen (Cyperaceae), which need to be secondary pollen from the year before deposited on the ground, perhaps pastures. These taxa flowers later on than, normally in June-July. It was observed that leaf tips of the grass *Poa trivialis*. Also pollen of Ceralia and charcoal dust has followed to selected food. Birds were observed in the fields feeding on *Callitriche* sp., and solitary Wiegon males frequently also the flowering part of *Equisetum fluviatile* (Jacobsen 1986). In the samples the most attractive plants have been *Salix* and the flowers of the submersed *Myriophyllum alterniflorum.*

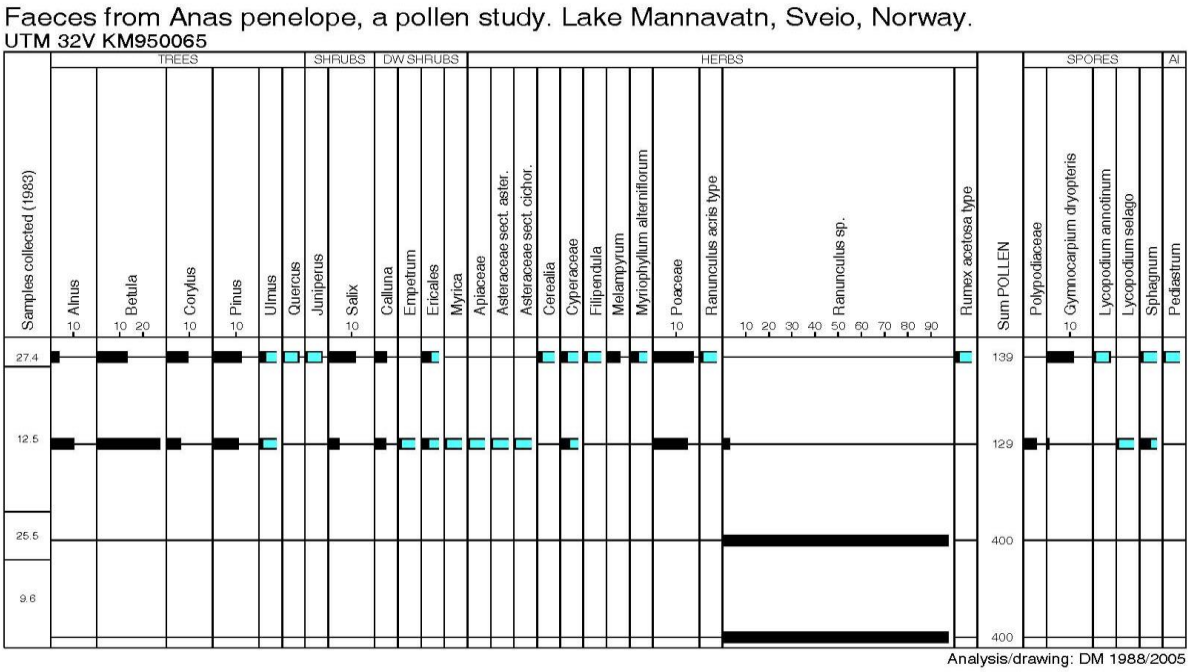


Figure 3. Pollen diagram based on faeces samples from 27th April, 12th and 25th May, and 9th June, all 1983. The values are presented in % of total pollen. (The black column x10.)

The samples from 25th May and 9th June are dominated by pollen of *Ranuculus* type. It is earlier known that different animals compose their own menu, and the high values of *Ranunculus* pollen reflect that the flowering *R. acris* and *R. flammula* have been selected by some individuals both at 25th May and 09th June. In other studies other species have been selected by some, and not all (for sheep see Moe 1983); goat (Justesen 1992) and the bird, Willow Grouse (Moe & Bjune 2009). Nearly all taxa within the family Ranunculaceae are insect pollinated species, and are known for some nectar, attractive for insects, but also the pollen itself is rich in nutrient. Despite a very low number of samples, it is obvious that the samples from 25th May and 09th June demonstrate use of selected, attractive fodder plants rich in nutrient.

Plants \Sampling dato	09th April	12th April	17th April	18th April	20th April	25th April	06th May	12th May	19th May	02nd June
Equisetum sp.	+ terr								+	
Poa sp.			+ terr							+
Poa pratense	+	+ terr				++terr				
Carex rostrata		+ terr			stems					
Trifolium repens			roots							
Potamogeton					+ lac				+ lac	
Ranunculus sp.					+ ?	++ lac		++ lac		
Ranunculus repens									++	
Glyceria sp.								++	++	
Callitriche								+ lac		
cfr. *Limosella aquatica*									+ lac	
Terrestrial plants		+					++			++
Overflateplukk		+ terr								
Invertebrater-chironom.		+		++		+	++			

Figure 4. *Anas penelope.* Observed used plants and chironomides by the birds in the period between 09th April 1983 and 02nd June 1983 (After: Jacobsen 1986). Abbr.: + Observed used; ++ more intensive used; terr = dry land habitats; lac= water/shore lake habitats). Additional observations: 12th April: only terrestrial vegetation, surface pluck, chironomidae exist; 18th April: Large hatching of Chironomidae and *Ephemergtera* near *Carex*-zone, and intense surface pluck; 25th April: invertebrates, some concentrations used by the wigeons; 06th May: Still large hatching on invertebrates, - feeded by the wigeons. Also terrestrial vegetation was used.

Conclusion

The case study does not give any complete survey of use of plant fodder for the wigeon in the selected period. The comparative study show, however, use of both dry land and wetland habitats with use of obviously nutrient rich *Salix* catkins, but at the same day, 27th April, also attractive *Myriophyllum* flowers from the lake. Also 12th May, the birds have used dry land habitat in addition to the observed lacustrine belt around the lake. Some birds are observed eating *Ranunculus repens* that day, while first the sample from 25th, May, and the next at 9th June fully demonstrate use of this plant species. If the actual birds are able to digestive the energy rich content of the pollen, is not studied.

The studied pollen sample shows an additional technique for tracing different kind of plant fodder with use of faecal or also coprolite material. The technique is well known and used for birds as well as mammals (e. g. Moe 1983; Justesen 1992; Bjune 1998; Bjune et al. 2004; Moe & Bjune 2009). Obviously a larger number of samples will give more precise results. The results however, give ideas about changes in the use of fodder also within an important period of their life.

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