Stahlman beekeeping notes for 2021

Issue # 7 [2-14-21]  Pollen load of a honey bee

What does one do during cold rainy or snowy days during February? Over the years I have always had an interest in microscopes. I have three and each one serves a different purpose. The problem I have is finding time to work with them. Weather this year is a bit different from last year – more rain and colder days. Friends in Ohio, Indiana and Michigan share stories about snow and temperatures in the teens.

I have always been interested in pollen identification. There seems to be so many things to do that I just haven't gotten around to this for many years. My bees were flying (Feb. 4, 2021) and some bees were returning to the hive with orange colored pollen. The pollen pellets from one of the bees is shown above. The topic always comes up "Where is it coming from?"

First, I am not an expert in pollen identification but have an above average interest in the subject. I own several reference books which are somewhat technical and if one is interested in doing this on their own some reference books or sources are mandatory. One of the most valuable books I own for local pollen identification was published in 1991 by the North Carolina State Beekeepers Assn. called An Atlas of Selected Pollen Important to Honey Bees in the Eastern United States. I also have the following: Honey Identification by Rex Sawyer (Cardiff Academic Press), The Pollen Loads of the Honey Bee by Dorothy Hodges (London, Bee Research Association), Pollen and Spores by Ronald O. Kapp's (American Association of Stratigraphic Palynologists 1967), and Pollen grains of Canadian honey plants (Agriculture and Agri-Food Canada 1993).

Thus, I have a lot of help in pollen identification. Besides my reference library, I have an AmScope microscope.

40X-1600X Binocular Biological Compound Microscope with a camera hooked up to my computer. This camera allows me a number of settings and control of the pictures I take with the microscope. AmScope offers a number of microscopes in varying price ranges and if you are curious check their web site https://microscopecentral.com/products/40x-1600x-binoc.

From Dorothy Hodges there is a great deal of helpful information about pollen loads of a honey bee. She states that "44 to 70 pounds of pollen are required by an average colony." It may be an interesting subject to study the way honey bees gather and pack pollen into what she calls "loads".

I removed the pollen from what H.A. Dade calls one of the most remarkable adaptations in the insect world (Tibio-tarsal Joint (pollen press) and rear leg of the bee. A small bee can carry a very heavy load of pollen. A load is: fresh pollen [A paste-like mixture of moisture (nectar) and dry pollen from plants].

Hodges also points out that contaminates such as dirt and dust in the air and possibly chemical can be identified in pollen pellets (loads).

A quote from chapter 10 of Pollen loads of a honey bee: "Pollen Grains, which carry the male reproductive cells of plants, appear to our unaided eyes as colour dust, but under the microscope they are seen to be beautifully fashioned in a variety of shapes and sizes, decorated with sculptured designs – according to the plant family to which they belong.

What sets each apart from the others is the number of pores, size, and surface features.

So here are the pollen grains I collected from a bee in my bee yard just a week ago.

There are two reasons beekeepers may want to identify pollen grains: 1) to determine nectar sources in a sample of honey or 2) just find out what pollen bees are bringing back to the hive**.**

It is a popular opinion that one can tell which plant is producing pollen based on the color of the pollen.

Dorothy Hodges produced a number of charts showing colors of pollen. Of great value is the first edition of her book in which she did watercolor color patches of various pollen samples from plants. Among the plates in the book are color patches for early spring, early to late spring, late spring to early summer, early summer to summer, summer, and summer to late summer.

Using her chart for early spring I could select plants producing pollen by comparing my sample with the color in her charts. Accordingly, I could guess that the pollen being brought into my hive was coming on February 4 from: Snowdrops, Hazel, Crocus or dandelion. I haven't seen any dandelions in bloom around my neighborhood, nor have I seen crocus, tulips, or daffodils. We did have a flowering cherry in bloom until last week. Camellias are budding but I have not seen any in bloom.

In the very near future, we will have pollen from a variety of trees. But what is that bright light orange pollen being brought into my hives?

The only true absolute answer is to study pollen grains under a microscope to either eliminate or confirm a possible source.

This is my set up!

Not exactly a lab setting but this serves my purposes. I prepare slides using both dry and wet slide methods.

I like to view pollen grains from a number of angles. Top, bottom, side, and front views. Pollen grains come in so many sizes, shapes, textures, and features.

To read a pollen grain is to learn a language used by palynologogists (those who study pollen grains).

It gives me a headache to just work my way though a Key to Major Pollen Groups.

But for now, I am going to share what these orange pollen pellets look like under the microscope. (Any of you with experience doing this can share your technique of making slides with me).

I am going to share several magnifications and some of the features that allow me to adjust the contrast, saturation, hue, brightness, and gamma of the picture. This microscope also allows for many adjustments—increase or lower light levels from under the glass slide, increase magnification from 40X to 1600X. I can not make 3D slide pictures. If any of you have used a microscope, you understand the delicate issues of moving the glass slide on the stage and the focus issues of getting an exact picture of the object to be seen. Any movement up or down can distort the image. Pollen grains vary in so many different ways.

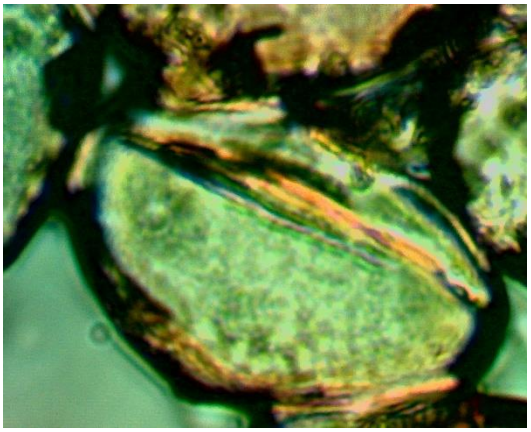
The job is to identify a single pollen grain.

Once I get the idea of the general shape I can go to my sources.

Using Kapp's guide, I need to find the shape of pollen and then go to the class I have identified in the key. It requires that I find the polar axis and equatorial diameter.

The apertures of pollen grains and surface scars provide the basis upon which a key is organized to find out the family of the pollen. What we see through the lens of the microscope is the exine or outer wall of the pollen grain. It does have an intine layer with higher proportions of pectic substances, callose and other polysaccharides (these can be seen at higher magnification – electron microscopes SEM's).

We need to look closer at the exine (outer surface of the pollen grain).



Note: The pollen pellet looked yellow/orange when it was gathered. But under magnification it took on a green cast as shown here.

This is a dry slide view. Looks something like a big watermelon.

By adjusting the focus of the grain, I determined the surface was a bit bumpy not smooth. The guide called this Verrucate.

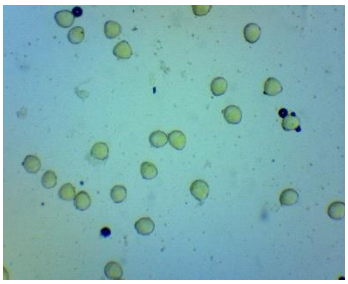
Fortunately, every pollen grain has at least three views – sometimes more! A two-axis view showing the poles width and height, a view from the end showing shape such as round, apertures, ridges, and pores, and surface features.

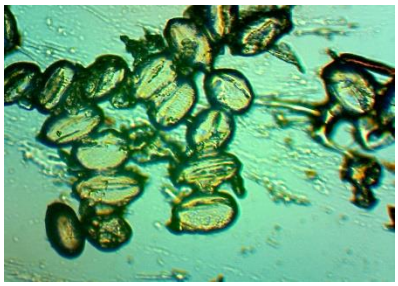
The photos of pollen grains in Pollen Grains of Canadian honey plants generally show two or three positions so an individual gets a general 3D idea of what pollen grains look like.

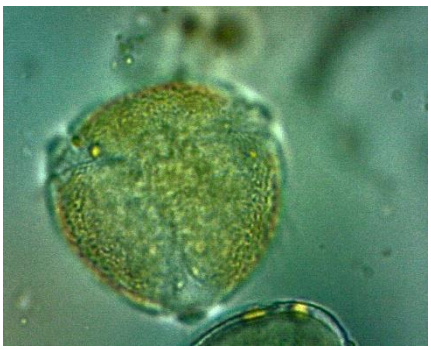
Under a microscope, individual grains of pollen can look like triangle shapes, footballs, sponges, burr balls as from a sweetgum tree – the shapes in many cases are unique and common to a species. The surfaces are covered in all kinds of patterns, all kinds of apertures, furrows, and pores.

Angiosperm **pollen** is extremely diverse and covers a multitude of combinations of features. Individual **pollen** grains may be inaperturate, or provided with one or more pores (monoporate, diporate, triporate, etc.), slit-like apertures or colpi (monosuclate, tricolpate, etc.), or a combination of pores and colpi (tricolporate, syncolporate etc.). **From a web search for information about pollen**

Let's look at the photos I took of these pollen grain from different orientations:

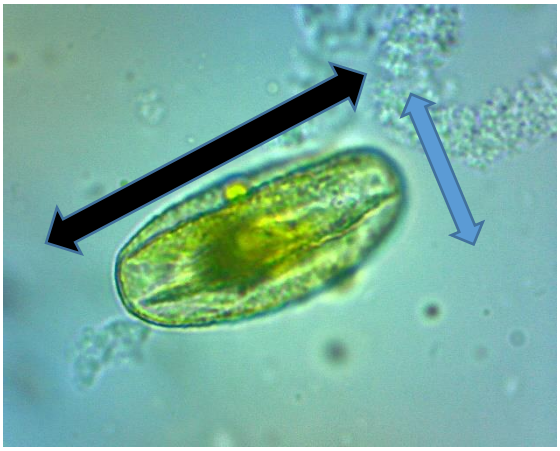






These five images will give you an idea of the enlargements a microscope can give for a single image. The last three provide the information I needed to try to identify the plant that produced them:

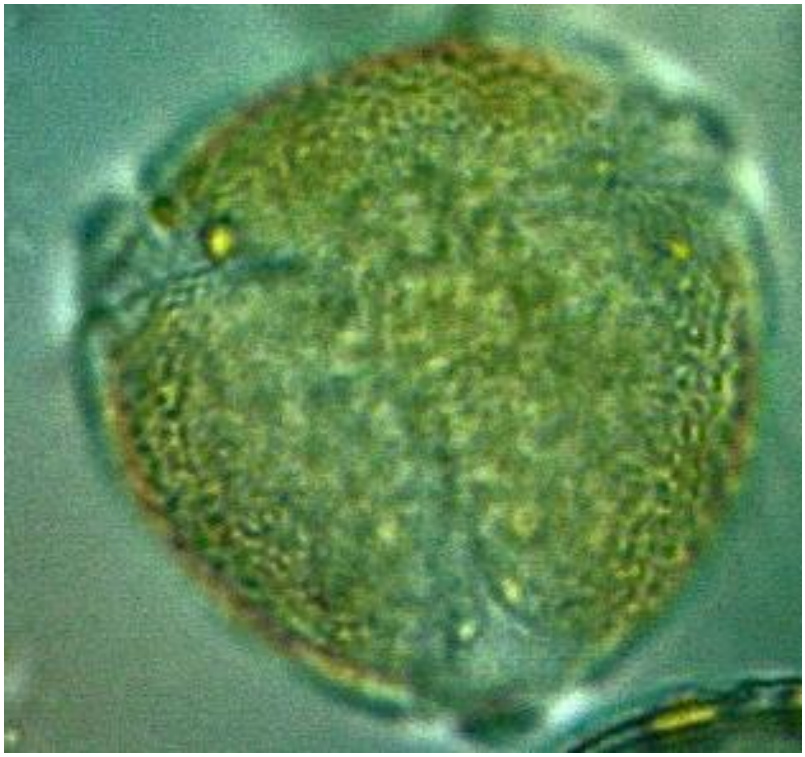
First the picture with a polar axis and equatorial diameter.



The Polar Axis is represented by the black line. The equatorial diameter by the blue line.

But there is much more to identifying a grain of pollen.

This is a heads-on view of the pollen grain. We can see that it has three scars or furrows that are boat-shaped apertures running the length of the polar axis. Pores are circular and in this case are located in each furrow. The exterior of the pollen grain has a definite sculptural feature.



To find what we are looking for in the Key is something called: trichotomocolpate –

(three furrows joined at one pole)

Then we check for surface and this is where it gets tricky. Are these bumps or are they spheroidal and netted?

Taking blooming season into consideration, I narrowed down a few choices.

[Salix discolor, Viola paulsustris] I have seen pansy groupings planted in some sub-divisions here in Raleigh. Bees may be visiting them but they are not large plantings.

Salix is the Latin name for willow an early blooming tree that blooms before it produces leaves.

I compared photos of pollen grains showing both species. The problem with identifying it as Viola is the surface features. Pictures show a rather smooth surface. Pictures SEM (Scanning Electron Microscope) of Salix examples fit more to the exterior of this sample. Salix has a clear and definite netting pattern somewhat like what is observed in the last photo I illustrated.

Judi and I walk on Wake County Park trails and we photograph a lot of interesting things.

This picture was taken on Feb. 4, 2021. This tree was found along the Falls of the Neuse River close to the Dam.

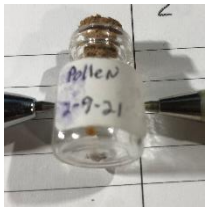
In a few weeks' trees close to blooming include Redbud (Cercis canadensis; various maple varieties (Acer rubrum – red maple; and Black Locust (Robinia pseudo-acacia)

The time to install package bees is when one sees trees in bloom!

We are four weeks from Mid-March when packages will be available. Those who live further north have still longer to wait.

Salix is one of the first **trees** to **leaf** out in spring and last to drop **leaves** in fall. My guess is *Salix* (one of the willow's in this large family of trees). I am looking for samples of flowers from plants/trees now so I can make more accurate identifications.

I depend a lot on the Dollar Stores to provide the needed small plastic bags and little glass bottles I use to store my samples before I prepare slides.



The middle bottle contains a queen bee just to provide an idea of how small these bottles are.