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Series

Defects in Raisins Inspection Aid No. 115

March 2026

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Defects in Raisins Inspection Aid 115

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INTRODUCTION

This document is designed to give guidance to Specialty Crops Inspection (SCI) Division personnel of the United States Department of Agriculture (USDA) in the examination of defects in the microanalysis of raisins.

Compliance with the Agricultural Marketing Service (AMS) guidelines does not excuse failure to comply with the Food, Drug, and Cosmetic Act or any other applicable Federal or State laws or regulations. SCI Division of the Specialty Crops Programs (SCP), AMS is responsible for grading/inspecting, audits and standardization programs of fresh and/or processed fruits and vegetables and related products. The legal authority for grading, auditing and standardization activities are the Agricultural Marketing Acts of 1936 and 1946, as amended.

Applicants may obtain inspections of any fresh and/or processed fruit and vegetable and related products for which they have a financial interest. The inspection service is voluntary and self-supporting and is offered on a fee-for-service basis.

GUIDE FOR ELECTRONIC USAGE

The AIM system of instructional manuals is available electronically in Adobe Acrobat Portable Document Format (PDF) at the following intranet address:
<https://usdagcc.sharepoint.com/sites/ams/AMS-SCI/SitePages/Home.aspx>.

When accessed electronically, AIM materials have hyperlinks and hypertext (visible as underlined [blue text](#)) available to the PDF user. Clicking on a hyperlink takes the reader to a web site with information relating to the subject. Hypertext links the reader to a different page within the current manual, or a different manual, with information relating to the subject. For example, the hypertext in the Table of Contents allows a reader to go directly to the section of interest in the manual by clicking on the section title.

PDF offers a variety of tools depending on the Adobe version the reader has. The newer the version, the more tools available. PDF documents are easily searchable for content within a document or within multiple documents. To learn about the variety of PDF search options:

- Click on the “Help” tab on the top of any page in Adobe Acrobat,
- Then click on the “Adobe Acrobat Help” bar,
- Type the word “Search” in the “Search” box, and click on the “Search” button,
- A series of options will become available,
- Click on the “Access Search Features” link and follow the instructions for the type of search you are interested in.

INSECT IDENTIFICATION

The most common insects found during microanalysis are:

- Dried fruit beetle,
- Indian-meal moth,
- Mealybug,
- Drosophila (Pomace, small fruit, or vinegar fly),
- Raisin moth,
- Sawtoothed grain beetle, and
- Sap beetles.

Also encountered may be:

- Leafhoppers and sharpshooters,
- Mites,
- Psocids or barklice, and
- Springtails.

Rarely occurring also are:

- Parasitic wasps, and
- Thrips.

Of the above insects, Drosophila flies, moths, beetles, and wasps exhibit complete metamorphosis. This means that the egg hatches into a larva (plural larvae) which eventually enters the pupa or resting stage, from which the adult emerges. The other insects listed (and the mites, which are not insects) hatch from eggs and develop into nymphs which resemble the adults. The nymphs increase in size and development and shed their skins until they are adults. This is known as incomplete metamorphosis, as the insect does not go through the four states (egg, larva, pupa, and adult) of complete metamorphosis.

The adult insects usually have three main body regions: head, thorax, and abdomen. The head bears the eyes, antennae, and mouth parts. Typically insects have three pairs of legs and two pairs of wings, all attached to the thorax. The thorax is divided into three segments with a pair of

legs on each. When present, the wings are attached to the middle (mesothorax) and last (metathorax) segments. The abdomen of an adult insect usually does not have appendages and resembles a segmented sack.

Dried Fruit Beetle

The dried fruit beetle, a sap beetle, is widely distributed throughout the world and attacks ripe and overripe vegetation, especially fruits. In California, the dried fruit beetle breeds in stone fruits, figs, melons, citrus, and grapes, then migrates from crop to crop as the fruits ripen. Its population increases through the season, and it is especially attracted to grapes with bunch rot.

Dried Fruit Beetle – Larvae

The newly hatched larva is yellowish and translucent but soon becomes creamy white with brownish ends. It has a pair of pointed tubercles on the end of the abdomen. Fully grown, it is sparsely haired and about 6 mm long.



Dried Fruit Beetle – Pupae

The pupa is pale yellow in color until nearly mature; then it darkens and is somewhat spiny. No cocoon is formed.

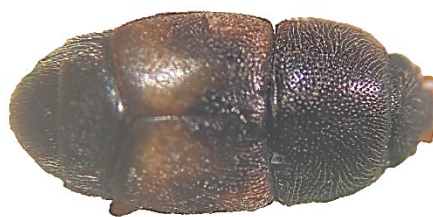
Dried Fruit Beetle – Adult

Adults are dark brown with lighter brown or amber spots on their wing covers. They are about 3 mm long, oval-shaped, and robust.

The wing covers are short, leaving the tip of the abdomen exposed. The antennae are knobbed at the tips. Legs and antennae are reddish or amber.



Bottom of Adult Dried Fruit Beetle



Top of Adult Dried Fruit Beetle

Drosophila

Drosophila flies are known by several common names, including pomace, fruit, and vinegar flies.

Drosophila – Eggs

Eggs are laid on fermenting fruit and are minute and oblong, with two appendages as long as the egg. Color varies from white to yellow. Eggs hatch in 24 hours, producing a slender white maggot (larva) which feeds on yeasts in the fermenting fruit. After four days, the maggots form pupae from which the adults emerge after another four days. A generation is completed in only nine days.





Drosophila – Larvae

Larvae are whitish in color and measure up to 7 mm long. They are identified by their typical maggot appearance and the presence of mouth hooks, dark H-shaped structures seen beneath the skin, at the anterior end of the larva.

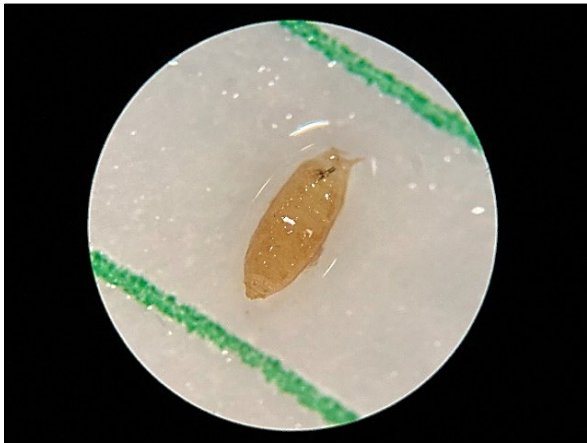


Three *Drosophila* larvae under the microscope.



Drosophila – Pupae

Pupae are somewhat shorter and bigger around than full-grown larvae and have two characteristic horn-like respiratory tubes. They are yellow to brown in color, and the red eyes of the developing adult may be seen within the pupae.



Drosophila – Adult

Adults flies are yellowish in color, about 3 mm long, and are easily identified by their red eyes.



Drosophila as in raisins seen under microscope.



Copyright © 2022 [Salvador Vitanza](#)

Vitanza, Salvador, *Drosophila (Sophophora) melanogaster species group*, 2022, BugGuide.net,

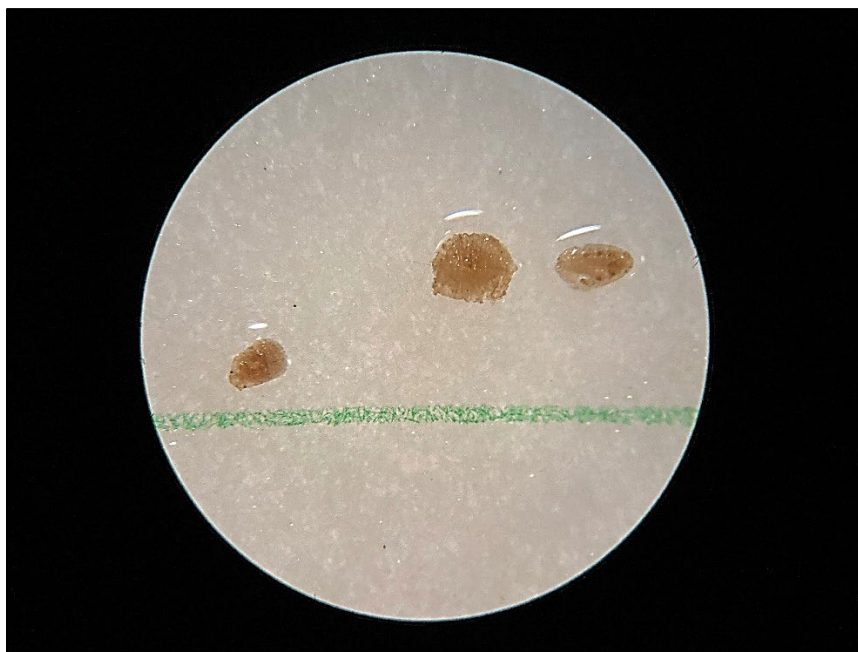
Accessed April 18, 2025 from <https://bugguide.net/node/view/2078236>.

Mealybug

Three species of mealybugs in the genus *Pseudococcus* may infest vineyards: the grape, obscure, and long-tailed mealybugs. For identification of mealybug species, visit University of California's [Mealybugs in California Vineyards](#) publication.



Microscope view at low magnification



Higher magnification of above picture



Zoomed in view of a mealybug



Zoomed in view of another mealybug.

Raisin and Indian-Meal Moth

The raisin moth and Indian-meal moth are treated as similar insects for the purposes of microanalysis of raisins. Both moths infest dried fruit and can greatly damage the raisins.

Raisin and Indian-Meal Moth – Eggs

Eggs are oval to nearly spherical, and may be yellowish (raisin moth), or pearly white in color and look like a golf ball (Indian-meal moth). See [Insect Eggs](#).

Raisin and Indian-Meal Moth – Larvae

Larvae of the moths appear as typical caterpillars. They may be brown, white, yellow, pink, or lavender in color, with a defined head.



Indian-Meal Moth Larvae



Indian-Meal Moth Larvae



Raisin Moth Larvae

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Raisin and Indian-Meal Moth – Pupae

Pupae are seen only occasionally; therefore, it is enough to be able to identify the typical hard, brown pupa case of a moth.



Indian-Meal Moth Pupa



Indian-Meal Moth Pupa



Raisin Moth Pupa

Raisin and Indian-Meal Moth – Adult

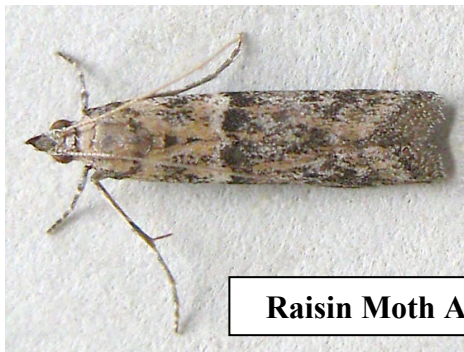
Adults may be observed flying about the lab and are rarely found in the samples. They are about 9-10 mm long, and the wings are folded around the body when at rest. The wings of the Indian-meal moth are dark brown and cream-colored; those of the raisin moth are drab gray.



Indian Meal-Moth Adult

**Indian Meal-Moth Adult**

Copyright © 2005 [Bob Patterson](#)
Patterson, Bob, 6019 - *Indian Meal Moth - Plodia interpunctella*, BugGuide.net,
Accessed April 18, 2025 from <https://bugguide.net/node/view/16325/bgimage>

**Raisin Moth Adult**

Copyright © 2024 [Jim Moore](#)
Moore, Jim, *Dusky Raisin Moth - Ephestiodes gilvescentella*, BugGuide.net,
Accessed April 18, 2025 from <https://bugguide.net/node/view/2407384/bgimage>

Sawtoothed Grain Beetle

The sawtoothed grain beetle is a very common pest that feeds on practically any stored dried food. Dry processed foods are their preferred food source in which both larvae and adults feed on. The saw-toothed grain beetle infests all cereals (rice, wheat, maize, barley, and pastas such as macaroni), bread, flour, nuts, starch, tobacco, and dried fruit. Raisins are a favorite, especially those stored for a year or more. They crawl rapidly, even on vertical surfaces, but have not been observed flying. Newly hatched larvae can enter extremely narrow crevices in search of food.

Sawtoothed Grain Beetle – Eggs

Eggs are laid individually in small clusters in the crevices of the skin of raisins. They are white, shiny, and elongated ovals. They measure less than 0.25 mm in length. Except for the color, they resemble dried fruit beetle eggs. See [Insect Eggs](#).

Sawtoothed Grain Beetle – Larvae

Larva is pale yellow with a dark band on each segment and a yellowish-brown head. They have six legs and the body is covered with numerous long hairs. The abdomen tapers to a blunt tip and lacks the four posterior tubercles of the dried fruit beetle.



Sawtoothed Grain Beetle Larva

Sawtoothed Grain Beetle – Pupae and Adult

Both the pupae and the adults show the characteristic “sawtoothed” outer margins, bearing six “teeth” on each side of the thorax. The adult is a slender, brown beetle, about 3 mm long.



Sawtoothed Grain Beetle Pupa



Pupa Transforming into Adult Sawtoothed Grain Beetle



Adult Sawtoothed Grain Beetle (zoomed)



Adult Sawtoothed Grain Beetle (under microscope)

Sap Beetles

In addition to the dried fruit beetle, there are many different species of sap beetles found in raisins and other fruit:

- pineapple sap beetle,
- Freeman sap beetle,
- confused sap beetle, and
- yellow-brown sap beetle.

Yellow-Brown Sap Beetle – Eggs

The yellow-brown sap beetle may be prevalent in raisin products and lay hundreds of eggs which hatch in 2-5 days. The eggs are whitish in color, oval, and slightly curved. It takes 5-11 days before the larvae mature and develop into pupae. See [Insect Eggs](#).

Yellow-Brown Sap Beetle – Larvae

The larva has nearly parallel rows of prominent dorsal tubercles on each segment and is whitish-brown in color.



Yellow-Brown Sap Beetle Larva (zoomed in)



Yellow-Brown Sap Beetle Larva (under microscope)

Yellow-Brown Sap Beetle – Adult

Adults are a uniform yellow-brown color and are long (2 - 2.5mm), flattened, and oval in shape. The complete life cycle is 21 days.



Yellow-Brown Sap Beetle Adults (under microscope). Beetles on both ends are on their backs.

Leafhoppers and Sharpshooters

Both leafhoppers and sharpshooters belong to the same order of insects and are very similar in appearance. Adult grape leafhoppers and sharpshooters are small slender insects 3 mm or less in length. They are usually pale yellow with reddish and dark brown markings. Coloration and markings vary with each species. The outstanding characteristics of this group of insects are the triangular head and slender, tapering body.



Leafhopper with partial damaged wings (zoomed in)



Leafhopper with wings (under microscope)

Mites

Mites are not insects but are closely related to ticks, which they resemble. They are exceedingly small and clear-bodied. The coloration varies greatly according to species. As adults, they can be distinguished from insects by the presence of eight legs. However, mites in the larvae stage only have 6 legs before molting into nymphs and adults (at which point they have 8 legs).

Photo#1200027



Copyright © 2016 [Thomas Dean](#)
Dean, Thomas, *Mite found in roach enclosure on banana peel*, 2016, BugGuide.net, Accessed
April 15, 2025 from <https://bugguide.net/node/view/1200027>

Psocids or Barklice

Psocids (barklice) are easily identified, usually pale grey or yellow in color. They are approximately 1 mm long and may or may not contain wings. The antennae are segmented. The insect has a short thorax and large oval-shaped abdomen. The abdomen is segmented, and the digestive track may sometimes be seen in it.



Copyright © 2012 [Diane Young](#)

Young, Diane, *Hyalopsocus* sp. – *Hyalopsocus*, 2012, BugGuide.net, Accessed April 18, 2025 from <https://bugguide.net/node/view/635382>.



<https://www.ars.usda.gov/plains-area/mhk/cgahr/spieru/docs/psocid-id-fact-sheet/>

Springtails

Springtails are very small insects, many of which have a forked furcular or “spring” folded beneath the abdominal segment. These insects are characterized by a fused abdomen of not more than six segments and antennae with four to eight joints. The young are usually white or colorless but become bluish-gray in color when reaching maturity.

Before failing any lot account springtails, consult your supervisor.



Copyright © 2016 [Mark H Brown](#)

Brown, Mark, *Springtails on fungus - Ceratomyza*, 2015, BugGuide.net,

Accessed April 15, 2025 from <https://bugguide.net/node/view/1184270>

Parasitic Wasps

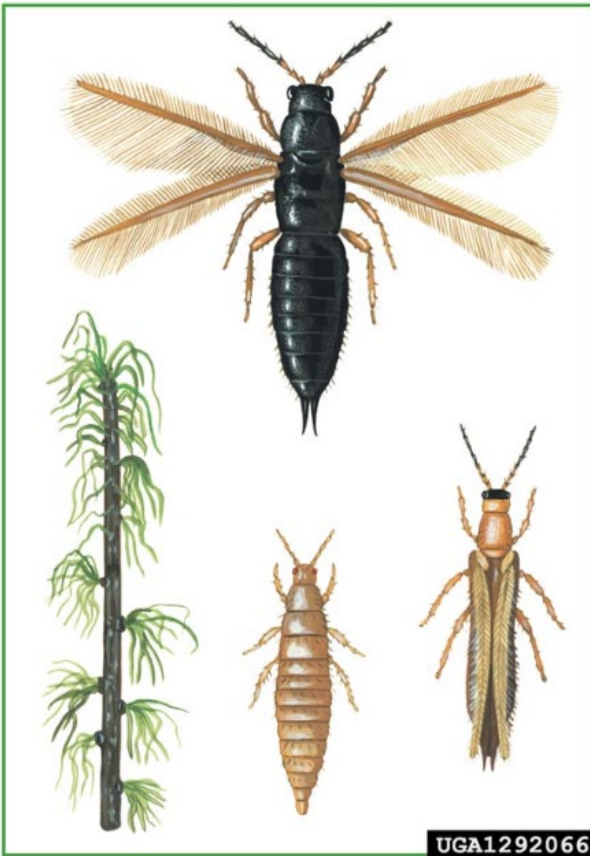
Parasitic wasps probably occur in raisin samples because of their relationship with the insects upon which they prey. Only adults will be found in the raisin samples. They are very tiny and most of them are dark brown to black. They have the characteristic “wasp waist” between the abdominal and thoracic sections.



Copyright © 2011 [Robert Lord Zimlich](#)
Zimlich, Robert, *Parasitic Wasp - Trichopria*, 2011, BugGuide.net, Accessed April 18, 2025
from <https://bugguide.net/node/view/524141>.

Thrips

Thrips occur only occasionally in raisins, and most of these will be nymphs. Nymphs are lighter in color than the adults and lack the characteristic fringed wings and red eyes.



Dzwonkowski, Robert, Bugwood.org, Accessed April 18, 2025
from <https://www.invasive.org/browse/detail.cfm?imgnum=1292066>.



Thrip in microscope



Zoomed in view of a broken up thrip.



Zoomed in view of a mostly intact thrip.

Other Defects

Other defects refer to insect parts and other contaminants such as feather barbules, barbs, and striated hairs.

Insect Heads

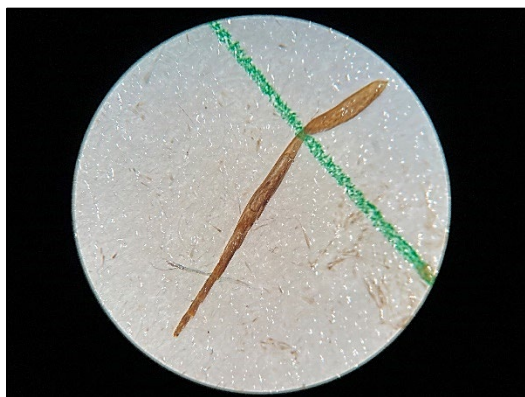
Insect heads do not include empty head capsules which are left behind when the skin is shed. Insect heads include those coming from insects that were killed by processing or treatment for microanalysis. Such heads will appear to contain “flesh.” Score these in the “Insect Head” section of the worksheet.



Insect head recorded as “Other Defect”

Insect Fragments

Some of the most common fragments found in raisin samples are empty egg cases, empty pupae cases, pieces of eggs, insect legs, wings, antennae, and segments of skin. Moth scales may also be found which are extremely small, flat, and elongated triangles.



Insect fragment (leg) as seen under microscope.



Insect fragment (antennae) as seen under microscope.



Insect fragment (wing) as seen under microscope.

Exceptions to Insect Fragments

However, if one of the following is found, it is not scored as a fragment, but as a whole insect:

- two thirds of an insect,
- head and thorax of an insect,
- more than one-third of a larva or pupa which includes the head, or
- more than one-half of an adult insect which includes the head. Care should be taken not to score an “Insect Head” and then a whole insect of which the head was a portion.



Scored as **whole** insect. Head and thorax of an insect.



Scored as a **fragment**.

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Insect Eggs

Only full egg cases are counted as eggs. Broken or empty insect egg cases are classified as “Insect Fragments.” *Drosophila* eggs should be counted under the [Drosophila - Eggs](#) heading. All others are recorded as “Other Eggs.”



Insect eggs which are not *drosophila* eggs (missing the two long appendages on them).

Mouth Hooks

Mouth hooks refers to the H-shaped mouth parts of the *Drosophila* larvae or pupae, separated from the insect body. Although it is tallied in a separate category, it is totaled with other fragments. There is no total for mouth hooks alone.

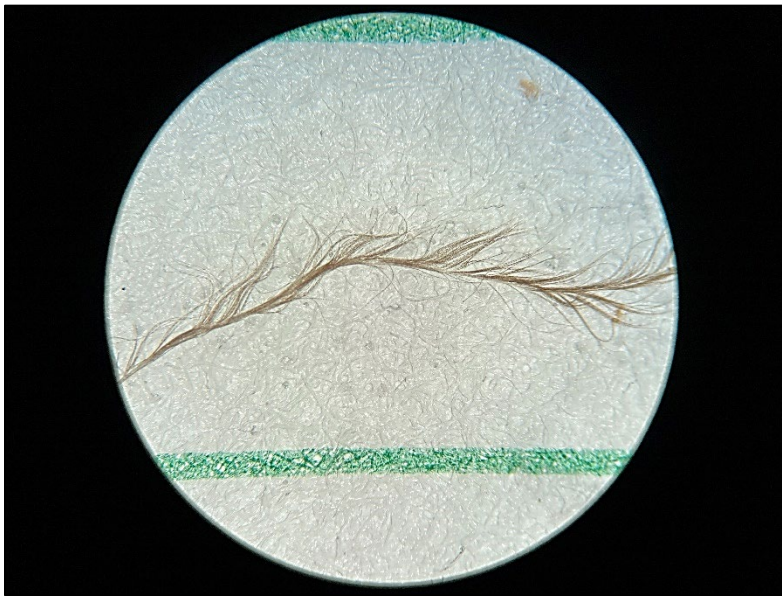


Other Defects – Mouth Hooks

Feather Barbules and Barbs

Feather barbules and feather barbs refer to portions of bird feathers. Barbs are branches from the shaft of a feather and bear many barbules. A barbule has several nodes which appear as swellings, much like bamboo. Nodes may appear as blank portions in the coloration.

- Whole Feather

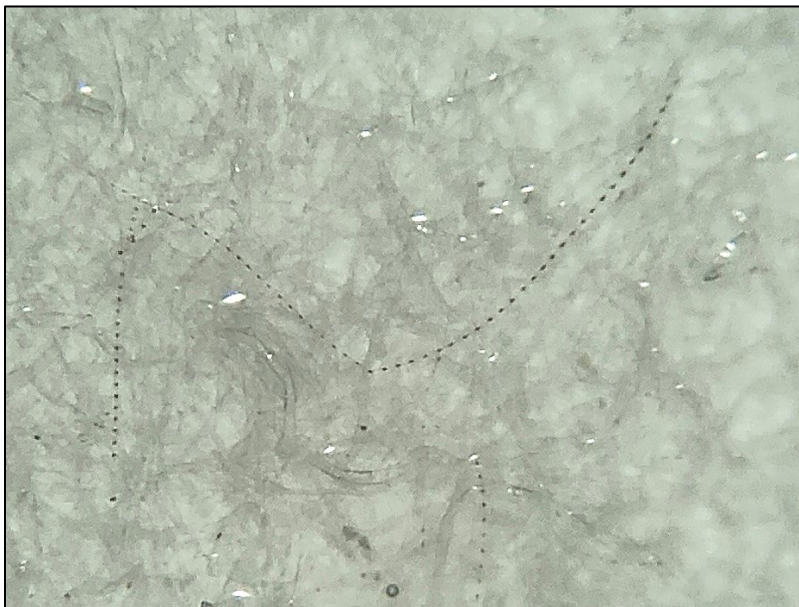


Whole feather under a microscope.

- Feather Barb (branches coming off the shaft containing multiple barbules).



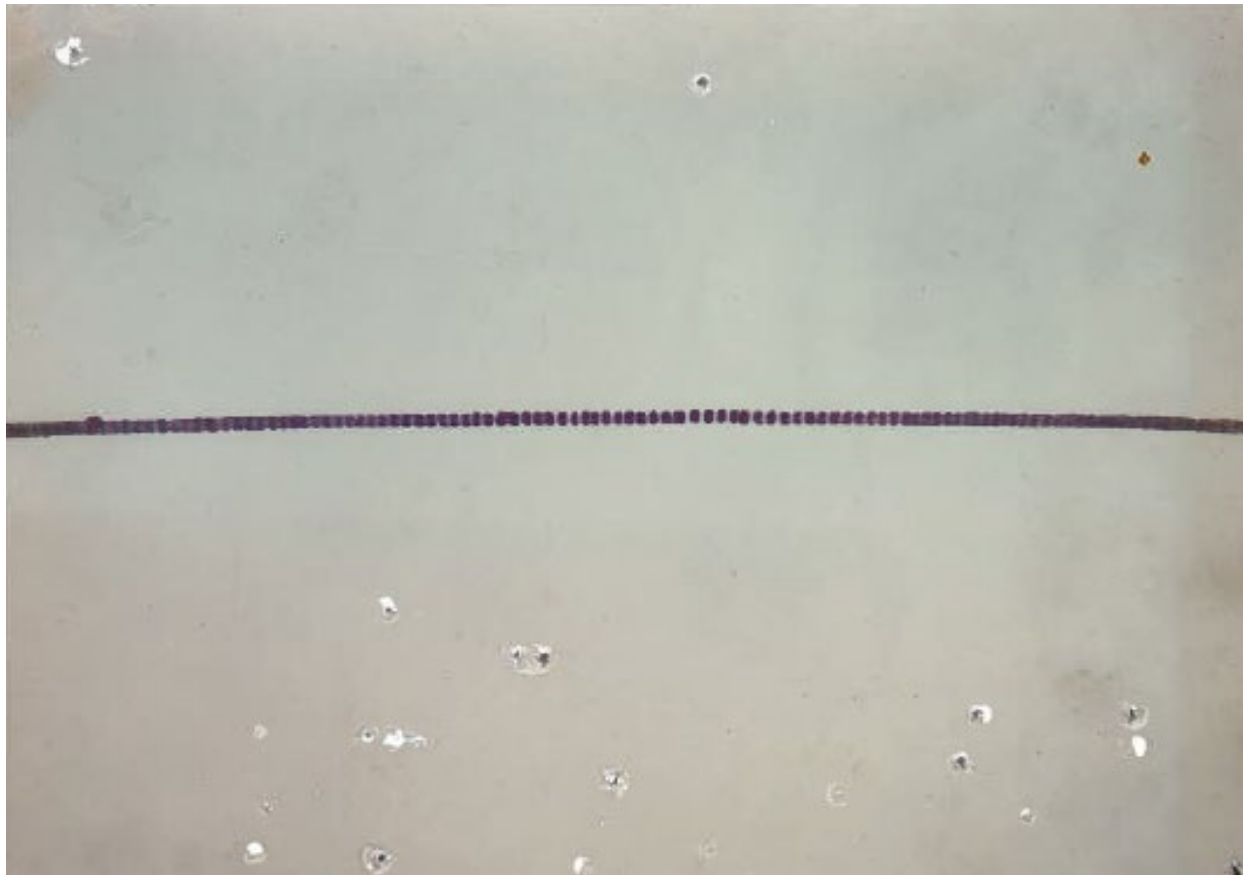
- Feather Barbules (further branches off the barbs – single strands)



Single strand of feather nodes or tear drop shape (zoomed in from picture above).

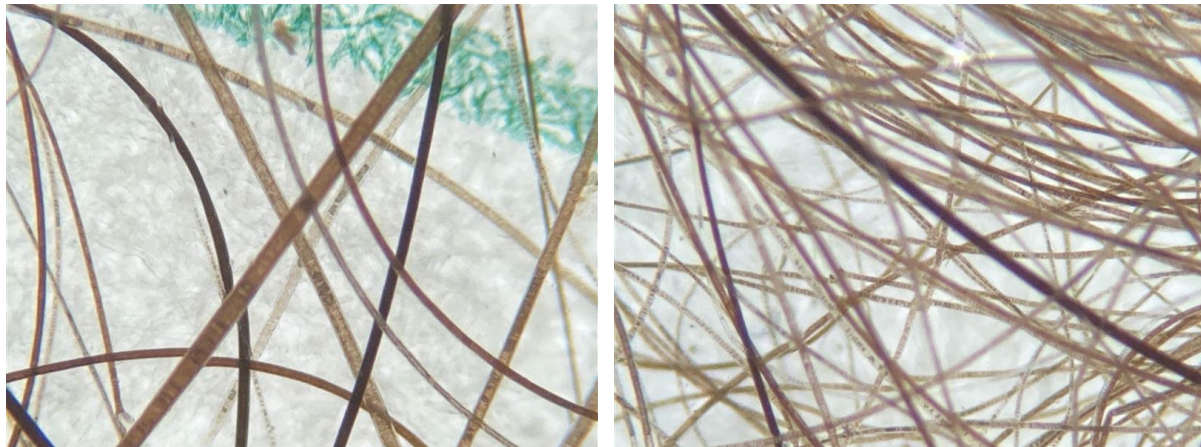
Striated Hairs

Hairs from cats, rodents, and other animals may be striated. Striated hairs are hairs with striations or narrow bands around them. Under the microscope, the hair between striations may be clear and almost invisible so that often only the striations can be seen. This gives the striated hair an appearance of “cross-ties of a railroad track.” Care must be taken to distinguish between feather barbules with nodes and hair with striations.



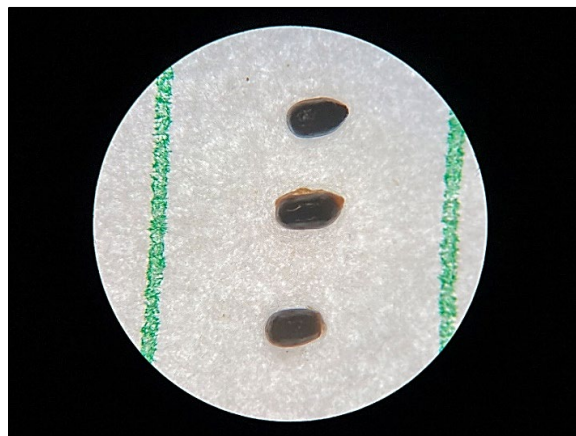
Other Hair

Count hair without striations as “other hair.” Other hair appears as a relatively uniform strand under the microscope.



Frass

Frass refers to the excrement or waste material that is produced by insects or their larvae.



Termite frass under microscope.

ACCEPTANCE CRITERIA

Established SCI Division Guidelines

See the [Foreign Material Manual](#) under the heading of Established SCI Division Guidelines

FDA Defect Action Levels for Golden Raisin

See the [Defect Action Level Handbook](#) under “Raisins, Golden.”