

CATEGORY 40

Epidermal Appendages

40I. double-outline trichome (one part may or may not appear more silicified; “base” is often spherical-elliptical or can have “straight” edges)

40IA. armed

a. armed only on base

1. blunt tip

2. acute tip

b. armed on tip (Boraginaceae, *Cordia/Heliotropium* diagnostic)

40IB. non-armed

a. outer edge straight

1. acute tip

00. large size

A. elongated bottom; short tip

B. small, pistol-shaped base; long tip

01. moderate size

2. blunt tip

b. curved tip

1. length of base greater than or equal to $\frac{1}{2}$ length of tip

2. length of base less than $\frac{1}{2}$ length of tip

3. length of base less than $\frac{1}{2}$ length of tip; base flat to sinuous

c. base rounded to oblong

1. not blocky

00. acute tip

A. whole trichome

B. broken off tips

01. blunt tip

2. blocky; may have indentations or ridges

d. triangular

e. curved; base not apparent; may be circular in top view

f. base with obtuse angles (Burseraceae, *Trattinnickia peruviana*, genus level diagnostic)

40II. single outline, highly silicified trichome

40IIA. armed

a. armed on all parts

b. armed on base only

40IIB. non-armed

a. outer edge straight

1. acute tip

00. smooth or grainy surface

01. uneven surface

2. blunt tip

b. outer edge curved

1. acute tip

00. smooth surface

01. uneven surface*

02. grainy surface*

c. cone-shaped

1. small with widely flaring base*

2. small to moderate size; no base or small base

3. small, rounded base; irregular conical shape; interior space; spherical, verrucose cystolith inside (Bombacaceae, *Pseudobombax millei*, genus level diagnostic)

40III. hairs (slender; elongated; double or single outline; with or without “base”)

40IIIA. unicellular

a. short to medium length. (Most of these are thin relative to length, there are examples that are “long” by our definition)

1. straight edges

00. rounded tip

A. rough surface

B. original 40IIIAa100

01. acute tip

A. interior space*

B. no interior space

a. armed (Fabaceae, *Dalium guianense*, genus level diagnostic)

b. non-armed

2. curving

01. interior space [sic: no 00]*

02. no interior space

A. acute tip

a. smooth surface*

b. grainy surface*

B. blunt tip

a. smooth surface

1. angled

2. bulbous (Bombacaceae, *Matisia longipes*, species level diagnostic)

b. grainy surface

c. scaled surface (*Dalium*, Fabaceae, genus level diagnostic)

3. hooked end

00. rounded interior space; small

A. old 40IIIAa300, *Phaseolus* (Fabaceae) hooked hair (genus level diagnostic)

B. hooked end is sharply recurved (Fabaceae, *Dalium guianense*, genus level diagnostic)

01. acute interior space; larger (Poaceae, *Pharus glaber*, not used as diagnostic)

02. double interior space (Euphorbiaceae; *Cleidium cf. castaneifolium*, genus level diagnostic)

b. long (many of these have thick bases)

1. armed

00. curving (Boraginaceae, *Cordia lutea*, species level diagnostic)

01. bent at a right angle from base (Moraceae, *Artocarpus altilis*, family level diagnostic)

2. non-armed

00. smooth surface

A. no base, or base seen as separate cell

a. interior space

1. double interior space (Flacourtiaceae,

Pleuranthodendron lindenii, family level diagnostic)

2. old 40IIIAb200Aa

b. no interior space

1. long to very long

2. relatively short (Bombacaceae, *Matisia longipes*, species level diagnostic)

B. base occurs as part of same cell

a. base flat

b. Attachment of hair to base “v”-shaped

(Ulmaceae, *Trema* spp., genus level diagnostic)

c. base spherical (Boraginaceae, *Lithospermium carolinense*).

Tips also break off, acute inner space

d. attachment of base to hair is rounded (*Watteria*, Sterculiaceae)

01. grainy surface (Boraginaceae, *Heliotropium angiospermum*,
genus level diagnostic)

40IIIB. multicellular hairs

a. segmented hairs

1. armed, large, no interior space NEED TO REVIEW--MOST HAVE THIS.

Check overlap with Piper aduneum hairs. (Asteraceae diagnostic)

2. non-armed

00. small, smooth

01. large, smooth, no interior space

(diagnostic to Asteraceae/Cucurbitaceae, *Cucurbita*)

CHECK TO SEE IF CAN SEPARATE THESE BASED ON SHAPES:

DATABASE PHOTO IS WRONG PLANT

02. large with interior space

A. can have roughened edges (Euphorbiaceae, *Croton fraseri*,
species level diagnostic)

B. *Piper* type, smooth edges, elongated acute tip,
restricted interior spaces

03. tip blunt

A. tip blunt and broad (Bombacaceae, *Quarariba cf. grandifolia*,
genus level diagnostic)

B. tip blunt, rounded elongated tip, grainy surface texture,
individual segments broad and squarish. (*Piper aduneum*)

b. radiating or stellate hairs

40IV. bases (epidermal cells)

40IVA. radiating appendages

a. discernable center

1. many irregular appendages; obtuse

2. long, regular appendages; acute

00. no surrounding epidermal cells

A. old 40IVAA2, flat base

B. central cell overlaid with small cells; tall in side view

a. Large, 30-50 μ (Burseraceae, *Trattinnickia peruviana*,
genus level diagnostic)

b. Small, constricted at center: <25 μ (*Casearia sylvestris*)
(Flacourtiaceae)

01. surrounding epidermal cells attached to form disk;
appendages relatively short

A. darkened

a. small (Bombacaceae, *Quarariba cf. grandifolia*,
genus level diagnostic)

b. large, with quadrilateral surrounding cells; tall in side view
(Fabaceae, *Inga densiflora*, genus level diagnostic)

- B. center has concentric pattern; tall in side view (Bursaceae, *Trattinnickia peruviana*, genus level diagnostic)
 - C. surrounding cells are angled (polyhedral) (Flacourtiaceae, *Pleuranthodendron lindenii*, family level diagnostic)
 - 02. lightly silicified surrounding cells; appendages long; large open circular center (Sterculiaceae, *Guazuma ulmifolia*, genus level diagnostic)
(Also in *Erythrina Amazonica* and *Lithospermum Carolinense* Boraginaceae CHECK)
 - 03. long appendages and 7 attached cells; large polyhedral center (Lauraceae, *Aniba hostmanniana*, family level diagnostic)
 - 3. short, regular appendages, angular rim
 - 00. rim adjoins circular center (Bombacaceae, *Pachira aquatica*, genus level diagnostic)
 - 01. rim is external to another ring around the center (Flacourtiaceae, *Tetrathylacium macrophyllum*, family level diagnostic)
 - b. non-discernable center
- 40IVB. comprised of rounded cells
 - a. large central cell with smaller surrounding epidermal cells
 - 1. central cell not clearly defined
 - 2. central cell rounded or elliptic; undivided; surrounded by small, elongated cells
 - 00. old 40IVBa2A, B, multiple rows of attached cells (Boraginaceae, *Cordia lutea*, species level diagnostic)
 - 01. single row of attached cells
 - a. side view has raised central area (Fabaceae, *Dalium guianense*, genus level diagnostic)
 - b. side view shows 2 layers of cells (Fabaceae, *Brownea ucayalina*, genus level diagnostic)
 - c. side view shows single flat layer of cells (Bombacaceae, *Huberodendron patinoi*, genus level diagnostic)
 - 3. central cell “isodiametric”; undivided; surrounded by small, rounded cells (Ulmaceae, *Trema* spp., genus level diagnostic)
 - 4. central cell rounded with clear divisions or rings that appear inside of base
 - 00. central cell is divided around the perimeter. Compare to 3: trema
 - 01. central cell has multiple clear divisions (*Pachira aquatica* type, stomata, moved to 120IIA)
 - 02. concentric ring pattern in central cell
 - A. rugulose/grainy surface; sinuous outline
 - 1. non-discernable center
 - 2. discernable center (Boraginaceae, *Heliotropium angiospermum*, genus level diagnostic)
 - B. smooth outline
 - 1. without projections
 - 2. with projections in a regular pattern (Boraginaceae, *Cordia hebeclada*, species level diagnostic)
 - C. smooth; with surrounding epidermis
- b. multiple cells; rounded; more uniform size
 - 1. highly silicified multiple central cells; appears darkened (*Cordia cf. polyantha*, species level diagnostic).
 - 2. amorphous central cells, difficult to distinguish from surrounding epidermal cells
 - 3. small, multiple central cells; 2 layers thick in side view (Fabaceae, *Brownea ucayalina*, genus level diagnostic)

4. Central cell is distinctive in being more highly silicified, sometimes 2 cells, 4 μ
(Piper) CHECK

c. Very 3-D, uniform rounded cells, 3-D in shape comprising 3-D mass, sometimes concave
(*Piper aduneum*)

40IVD. [sic: no C] spherical hair base; smooth (no rings) (Asteraceae/Cucurbitaceae diagnostic)
Central spherical (large) cell surrounded by rounded cells. May form a large 3-D mass of
rounded cells RECHECK SLIDE RE OVERLAP Q

40IVE. tear-drop shaped hair base; rough surface

40IVF. stellate center

a. projections short, or mere points; may have crystalline inclusions (Bignoniaceae,
Tecoma gandichiandi, genus level diagnostic)

b. projections medium length; with or without surrounding epidermis

c. long projections; with attached peripheral epidermis (Moraceae, *Ficus americana*,
family level diagnostic)

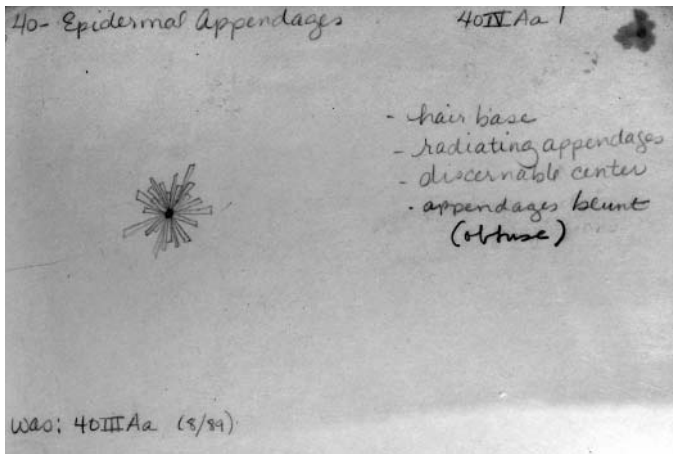
d. very small stellate center embedded in a well silicified body; 1 more ephemeral ring
(Moraceae, *Artocarpus altilis*, family level diagnostic)

40IVG. triangular shape

40IVH. quadrilateral shape

40IVN. flared shape [sic: no I-M]

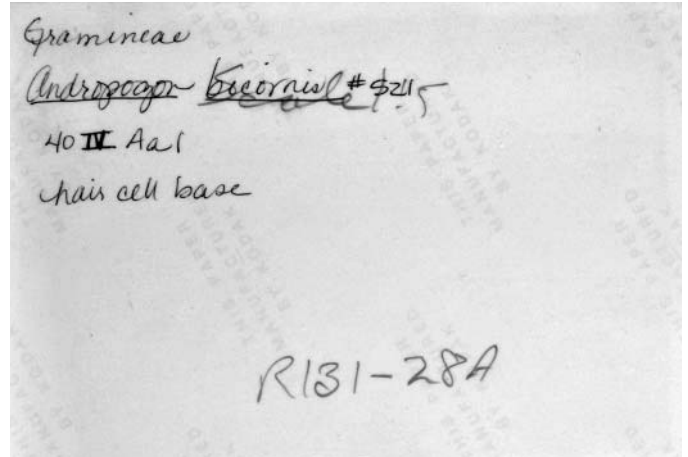
*No card in MU card file



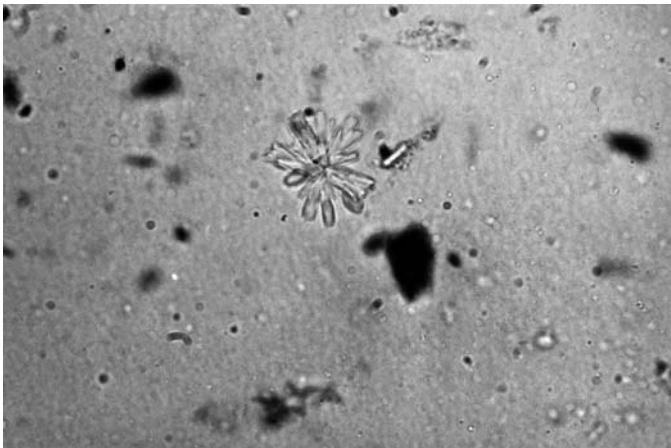
40IV Aa1 card 1.JPG



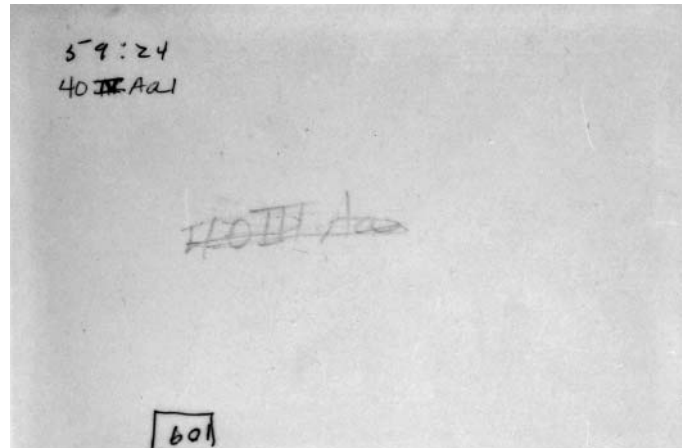
40IV Aa1 photo 1f.JPG



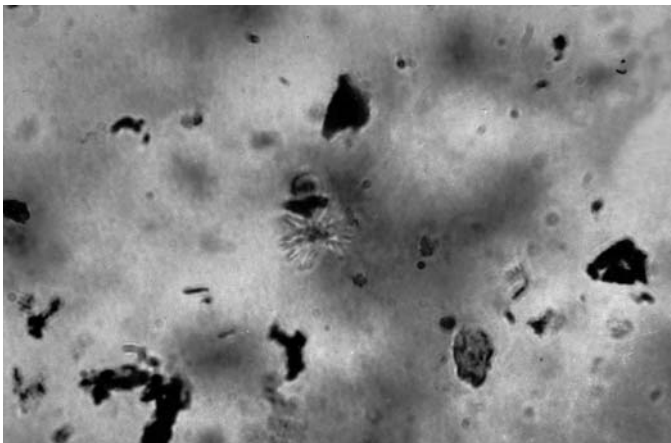
40IV Aa1 photo 1b.JPG



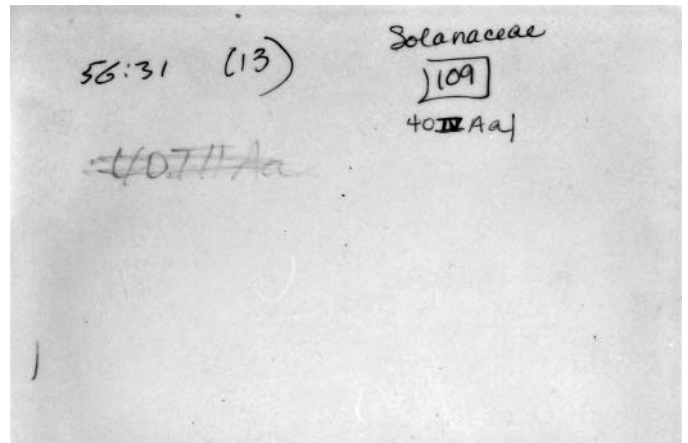
40IV Aa1 photo 2f.JPG



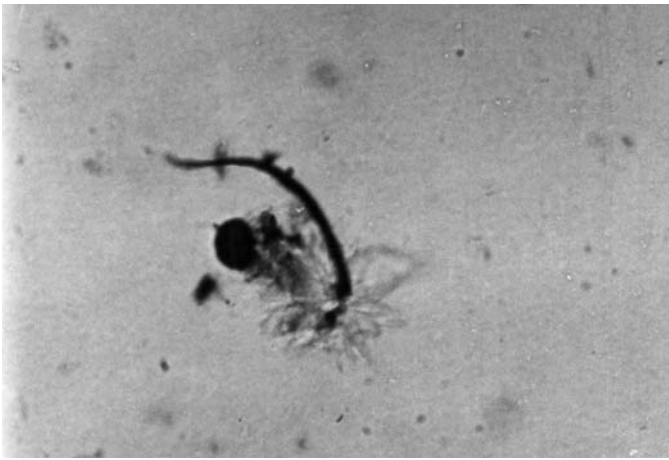
40IV Aa1 photo 2b.JPG



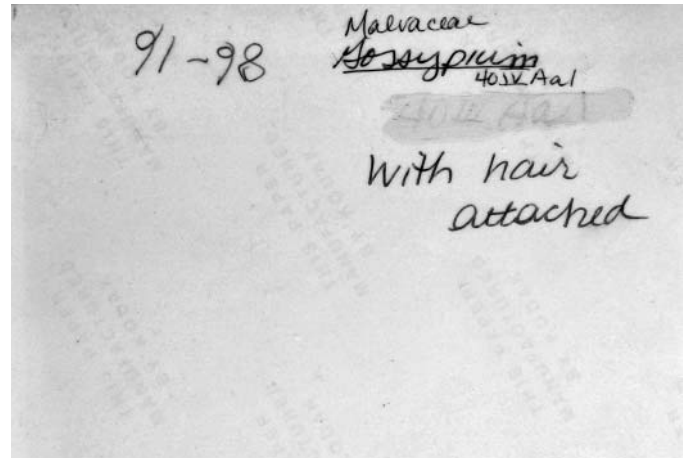
40IV Aa1 photo 3f.JPG



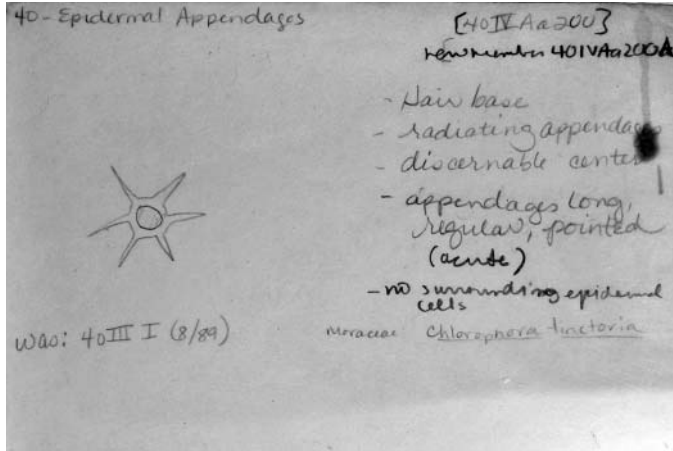
40IV Aa1 photo 3b.JPG



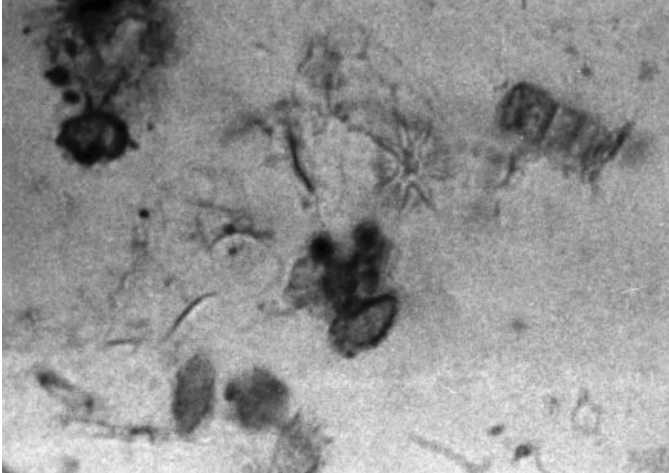
40IVAa1 photo 4f.JPG



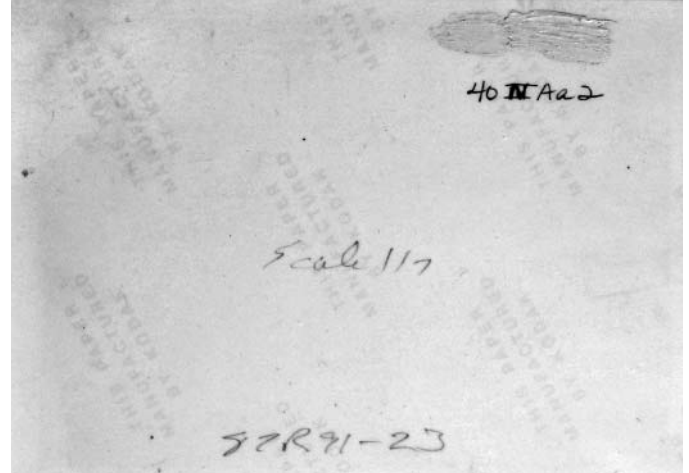
40IVAa1 photo 4b.JPG



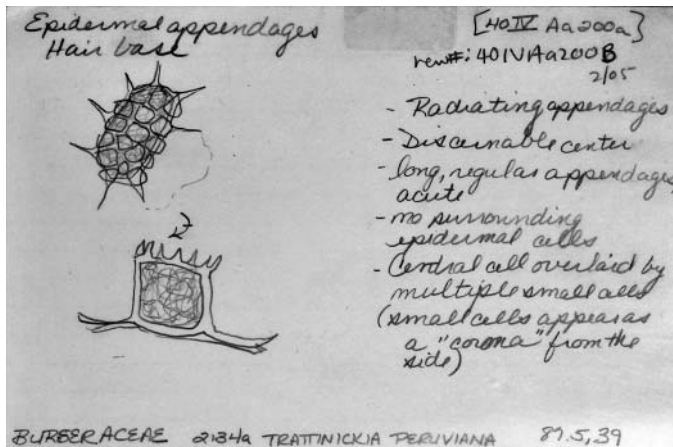
40IVAa200A card 1.JPG



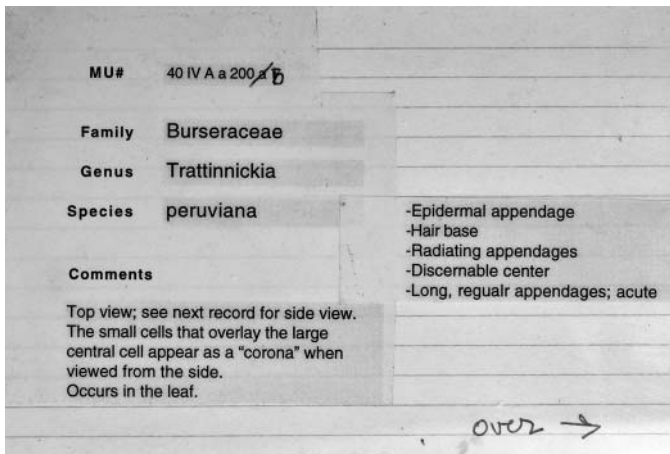
40IVAa200A photo 1f.JPG



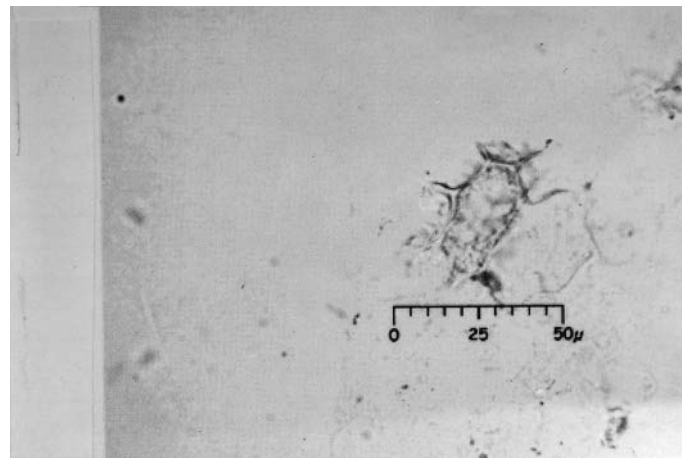
40IVAa200A photo 1b.JPG



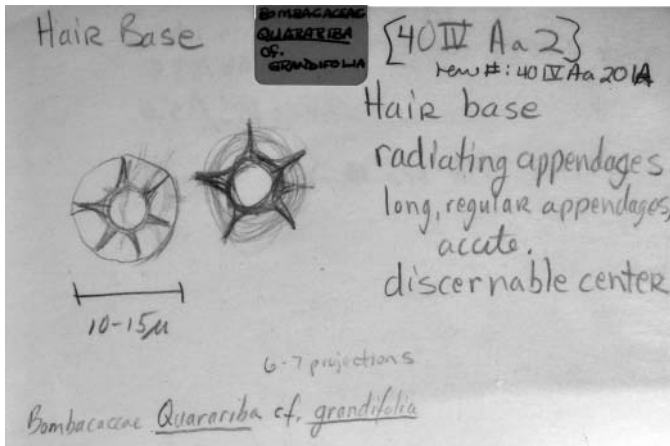
40IVfAa200B card 1.JPG



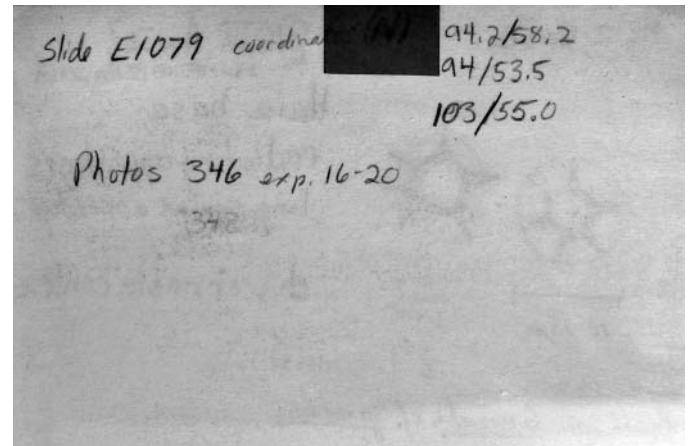
40IVAa200B card 2f.JPG



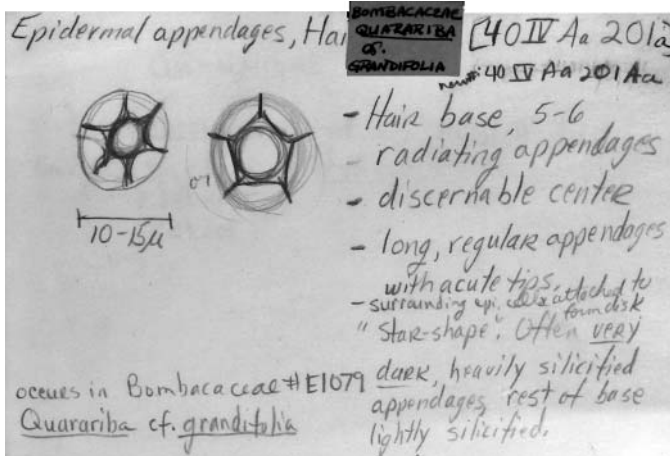
40IVAa200B card 2b.JPG



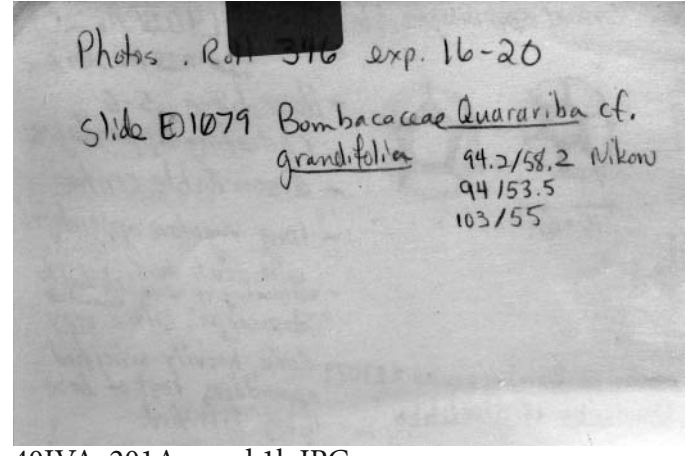
40IVAa201A card 1f.JPG



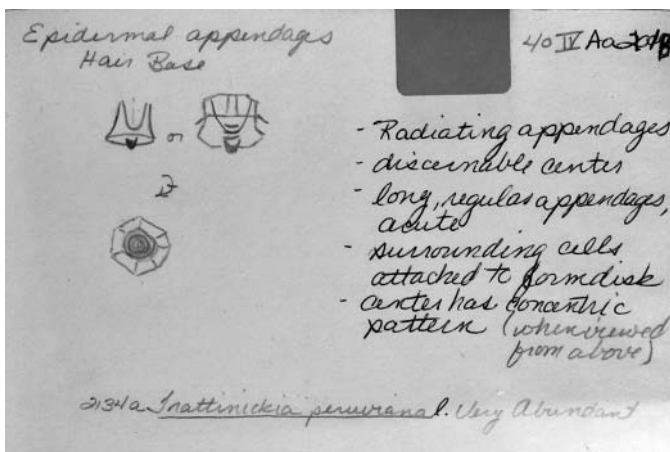
40IVAa201A card 1b.JPG



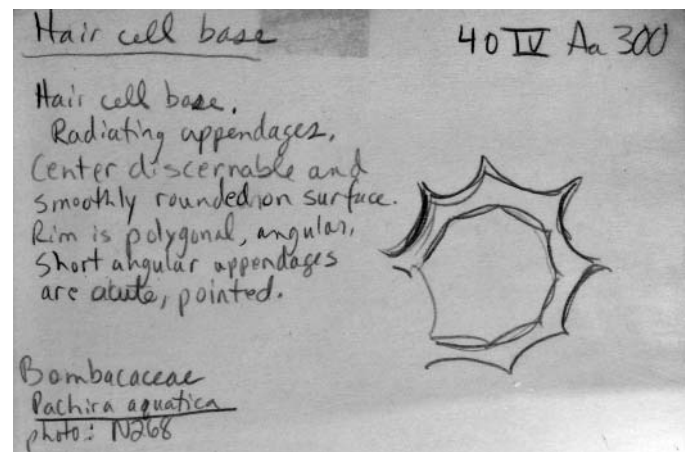
40IVAa201Aa card 1f.JPG



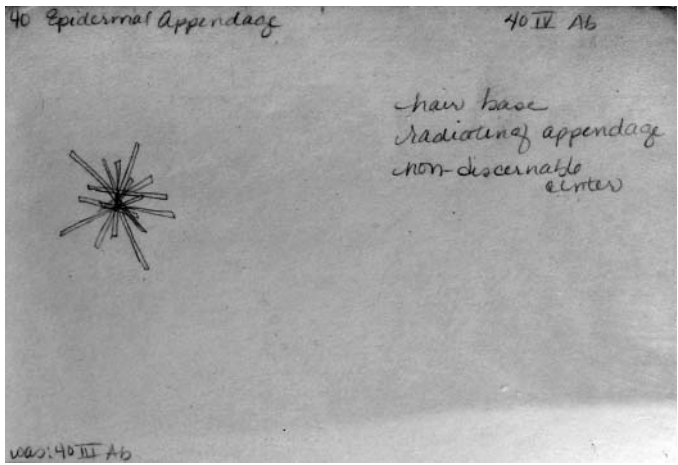
40IVAa201Aa card 1b.JPG



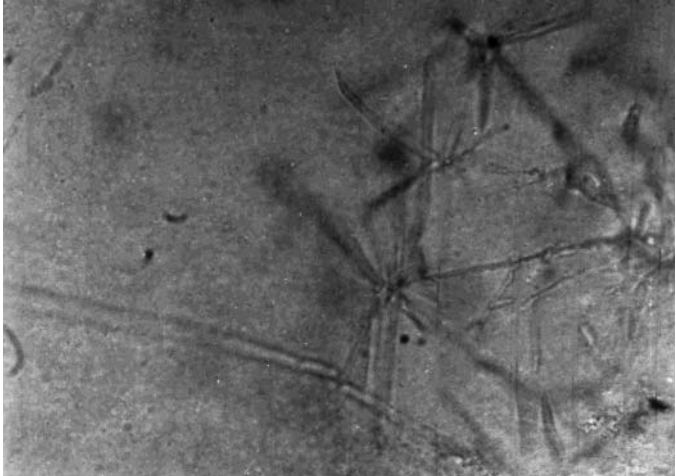
40IVAa201B card 1f.JPG



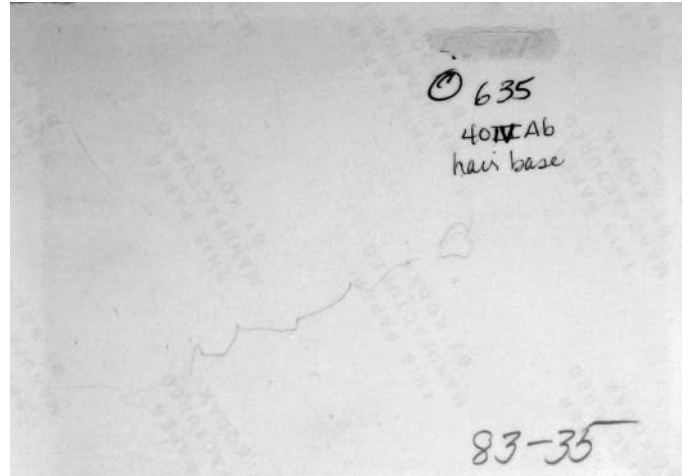
40IVAa300 card 1.JPG



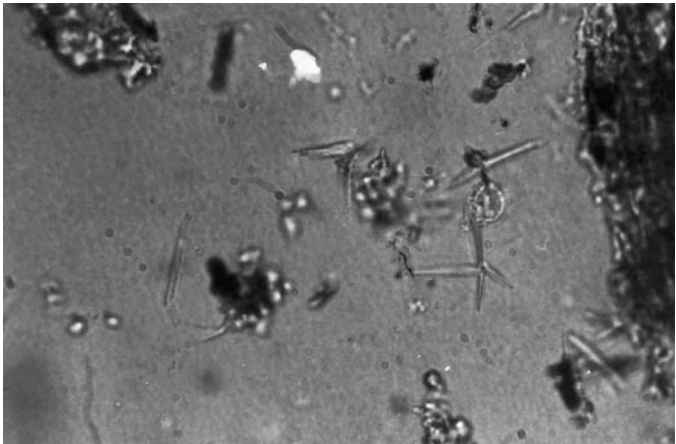
40IVAb card 1.JPG



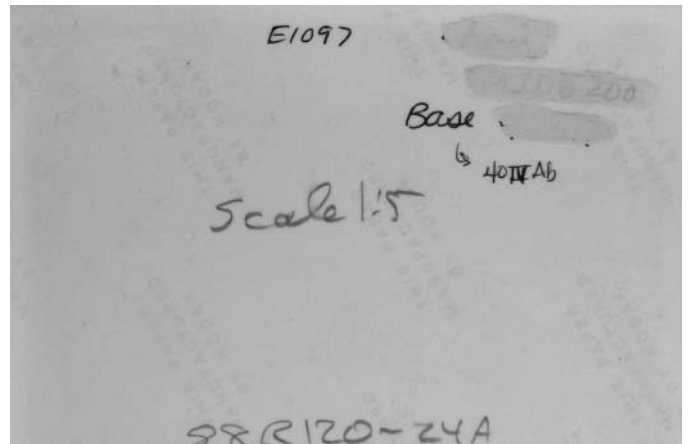
40IVAb photo 1f.JPG



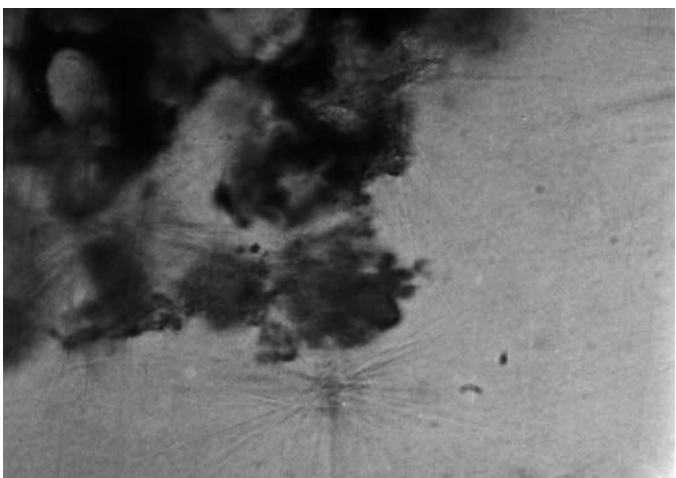
40IVAb photo 1b.JPG



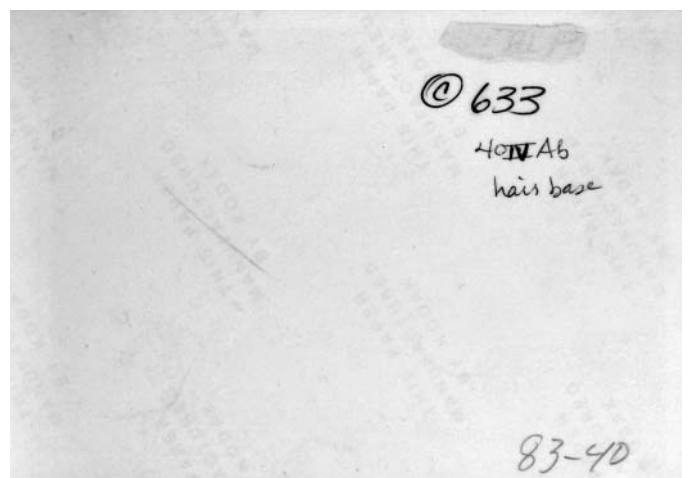
40IVAb photo 2f.JPG



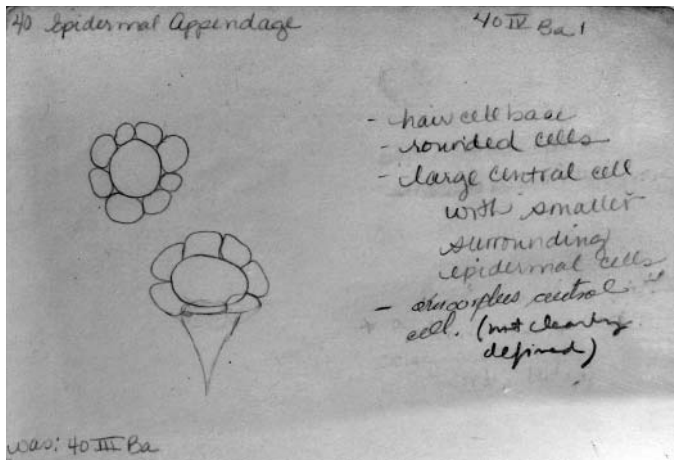
40IVAb photo 2b.JPG



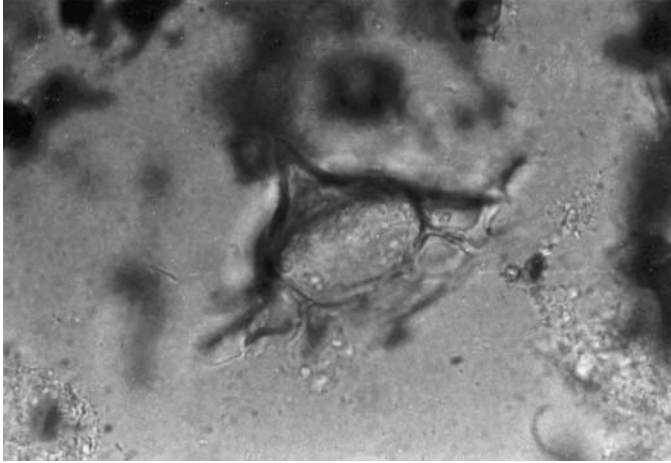
40IVAb photo 3f.JPG



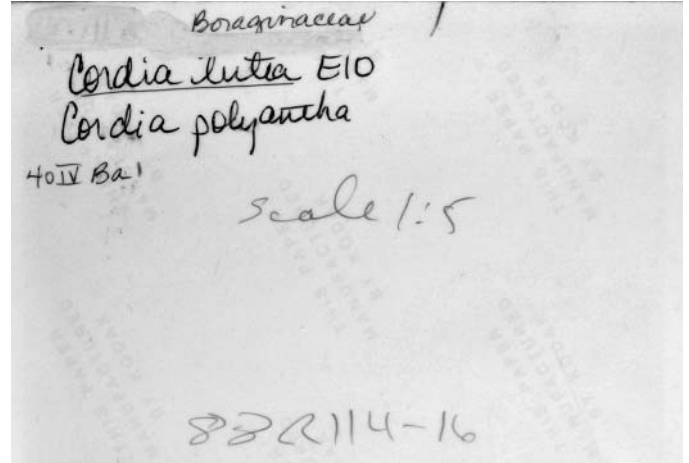
40IVAb photo 3b.JPG



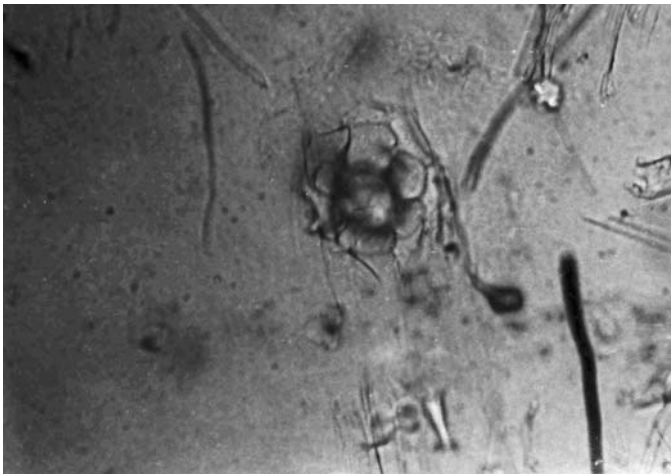
40IVBa1 card 1.JPG



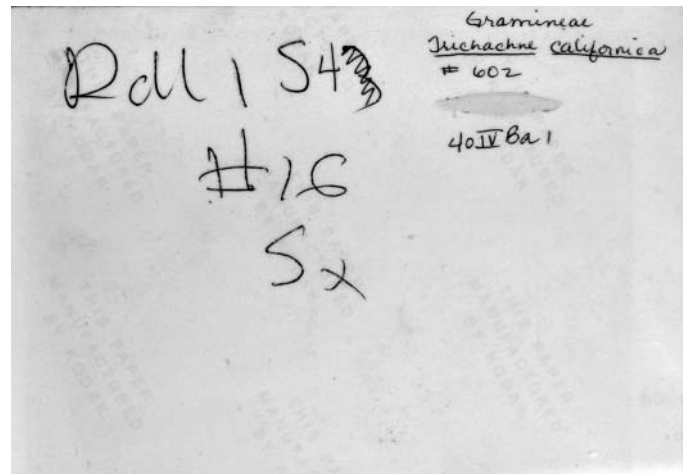
40IVBa1 photo 1f.JPG



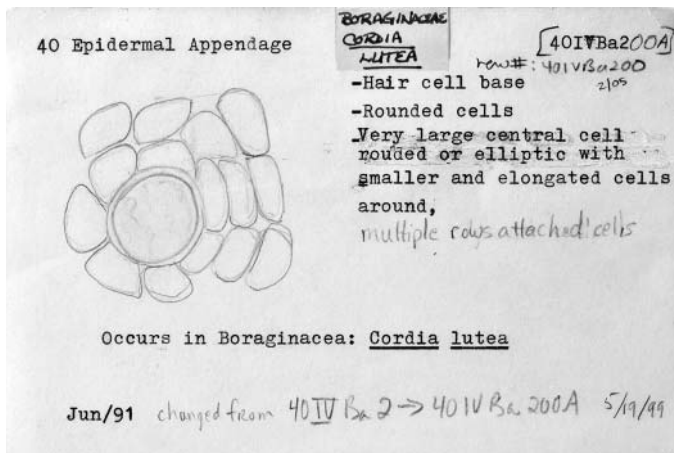
40IVBa1 photo 1b.JPG



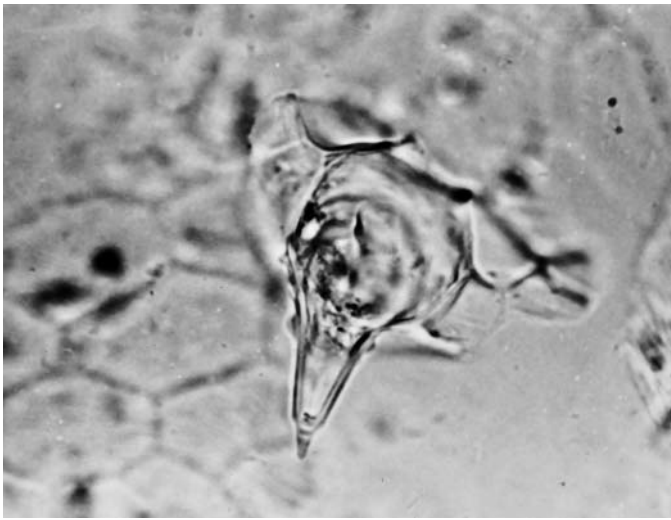
40IVBa1 photo 2f.JPG



40IVBa1 photo 2b.JPG



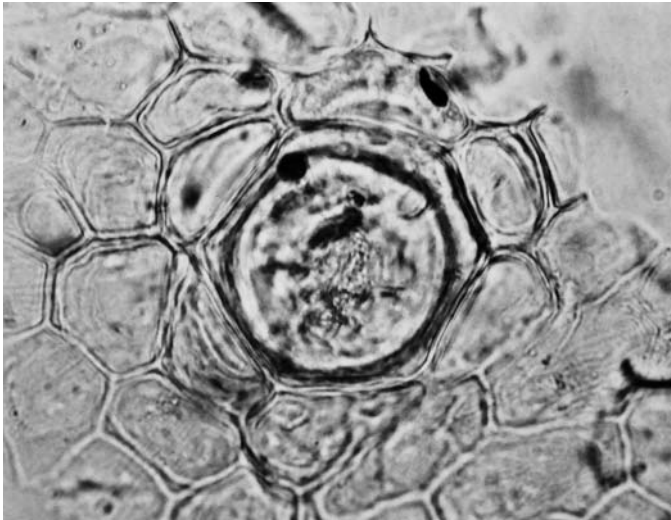
40IVBa200 card 1.JPG



40IVBa200 photo 1f.JPG

Cordia lutea
322
Boraginaceae
470 L
40 IV Ba 2
2

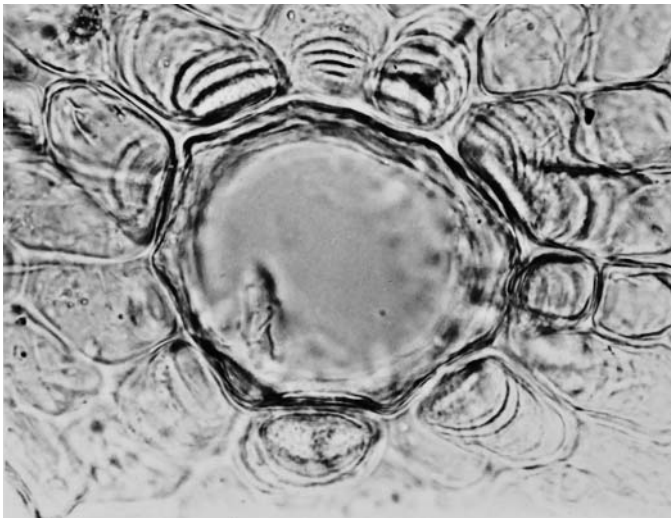
40IVBa200 photro 1b.JPG



40IVBa200 photo 2f.JPG

Boraginaceae
Cordia lutea #470 (leaf) 238
40 IV Ba 2. Fr 2
9sec

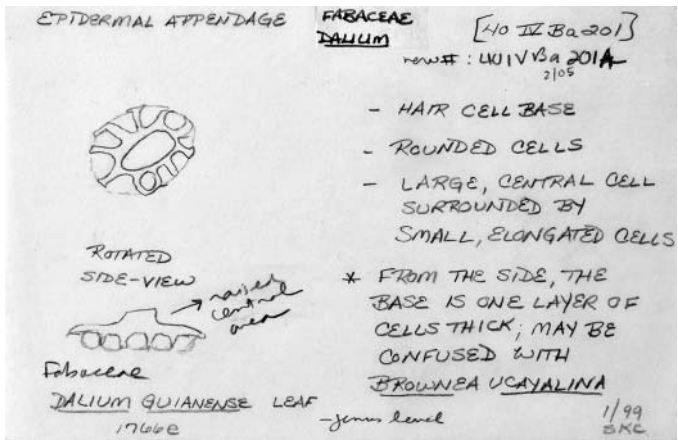
40IVBa200 photo 2b.JPG



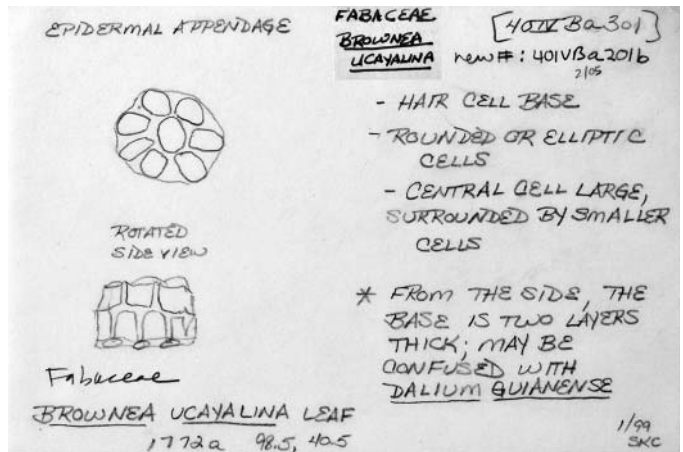
40IVBa200 photo 3f.JPG

Cordia lutea
322
470 L.
40 IV Ba 2
43

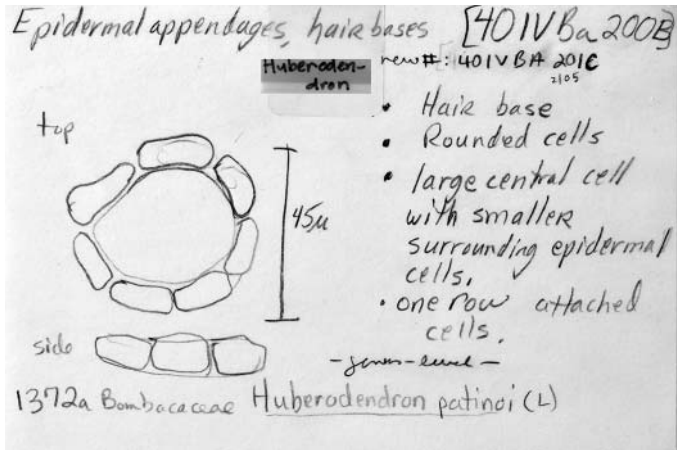
40IVBa200 photo 3b.JPG



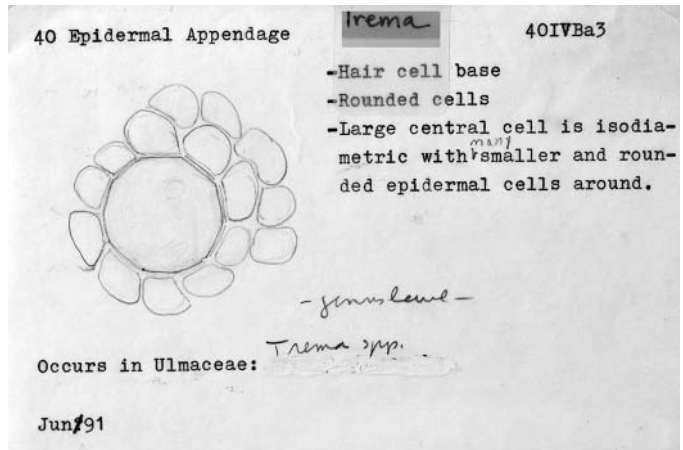
40IVBa201A card 1.JPG



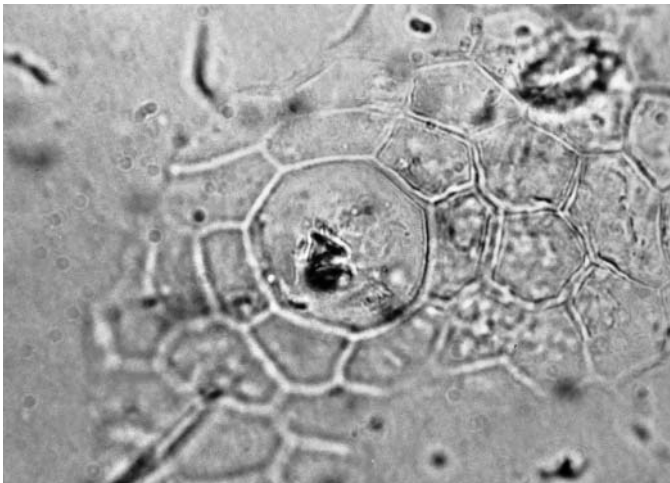
40IVBa201B card 1.JPG



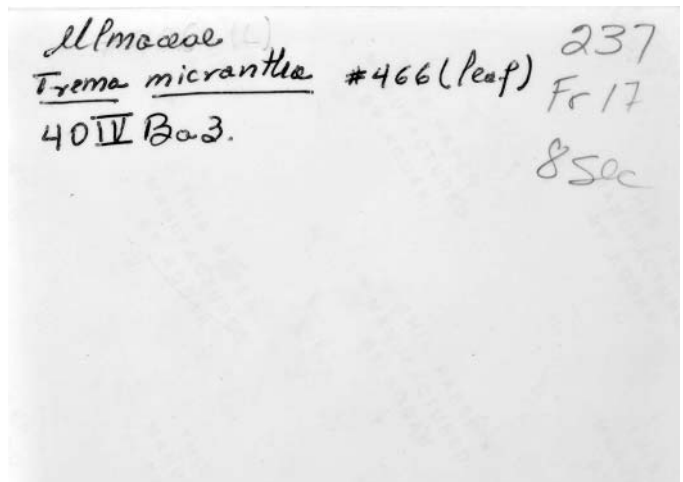
40IVBa201C card 1.JPG



40IVBa3 card 1.JPG



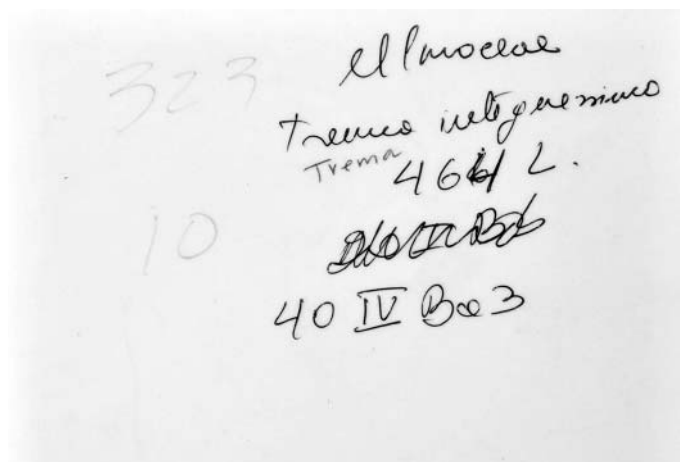
40IVBa3 photo 1f.JPG



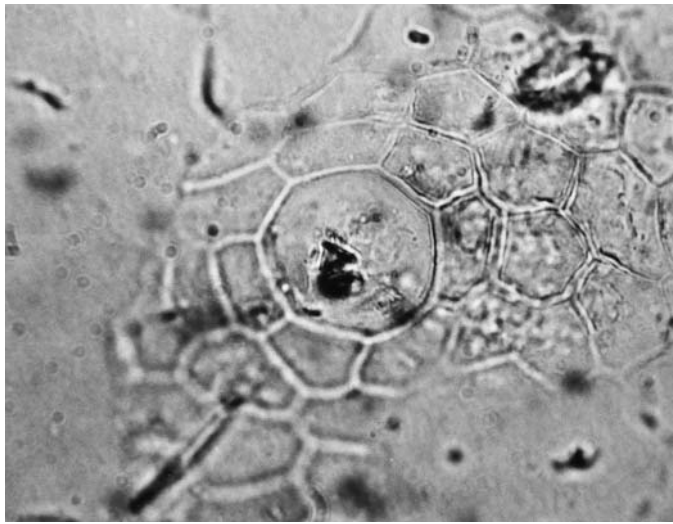
40IVBa3 photo 1b.JPG



40IVBa3 photo 2f.JPG



40IVBa3 photo 2b.JPG

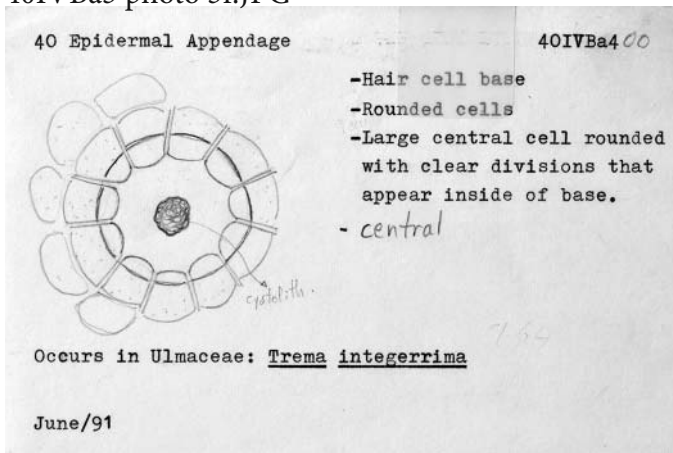


40IVBa3 photo 3f.JPG

Ulmaceae
Trema micrantha
 #466 (leaf)
 40 IV Ba3

237
 Fr17
 9 sec

40IVBa3 photo 3b.JPG



40IVBa400 card 1.JPG



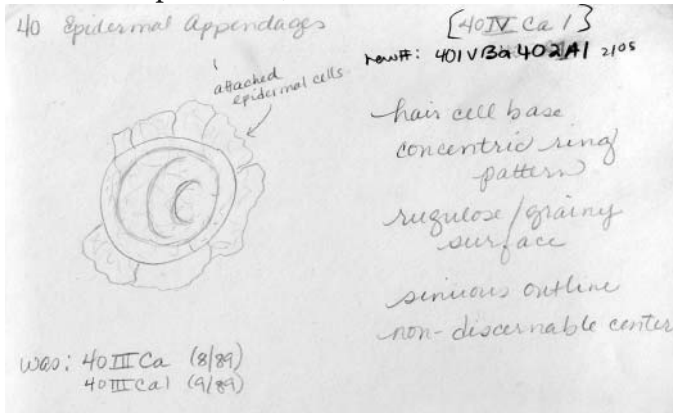
40IVBa400 photro 1f.JPG

Ulmaceae
Trema integrum
 464 L.
 40 IV Ba4

323

42

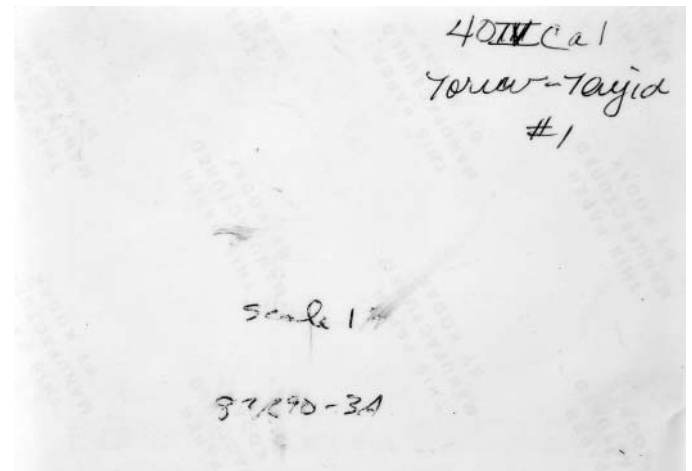
40IVBa400 photo 1b.JPG



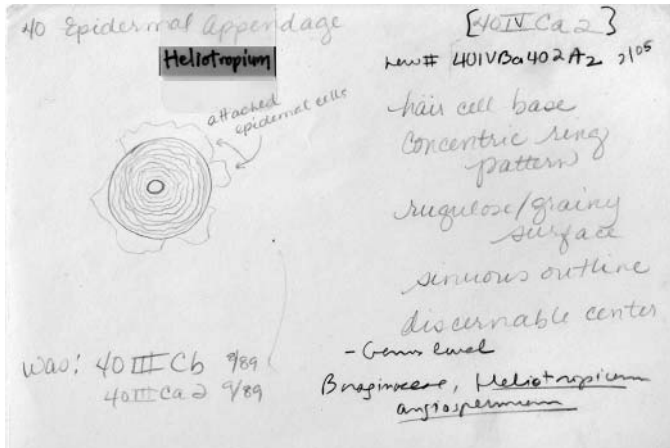
40IVBa402A1 card 1.JPG



40IVBa402A1 photo 1f.JPG



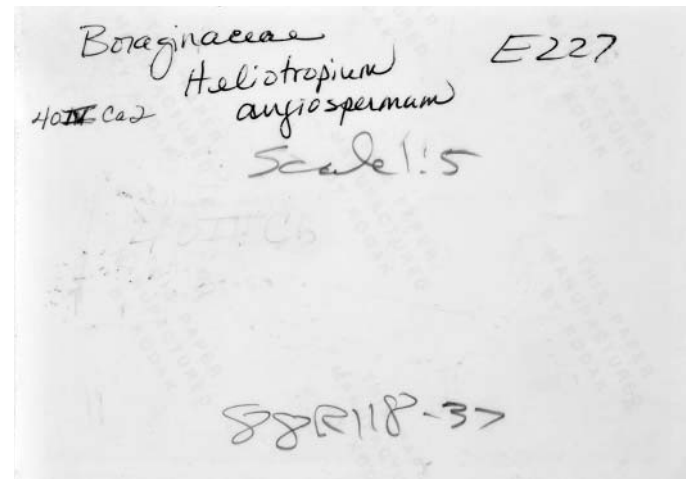
40IVBa402A1 photo 1b.JPG



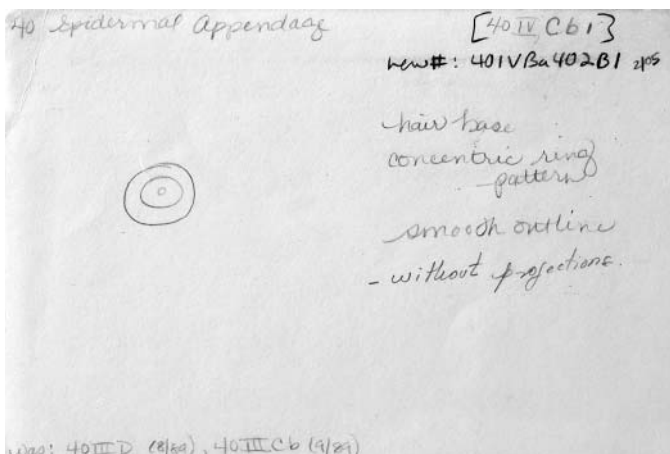
40IVBa402A2 card 1.JPG



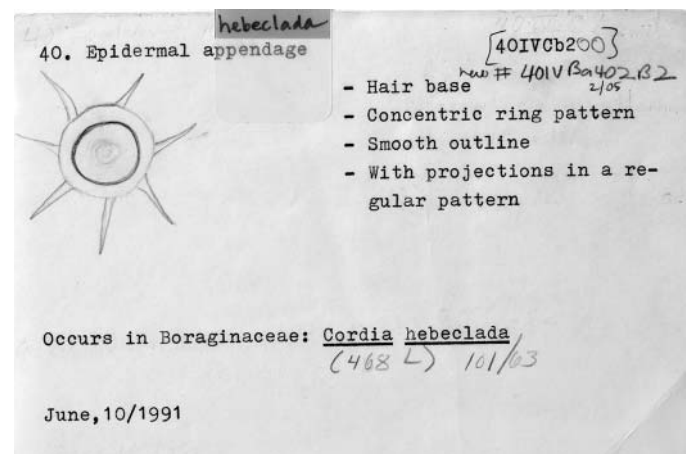
40IVBa402Aa photo 1f.JPG



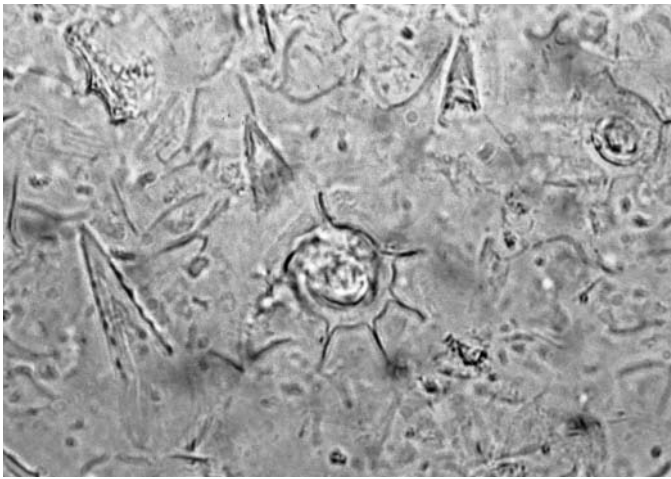
40IVBa402A2 photo 1b.JPG



40IVBa402B1 card 1.JPG



40IVBa402B2 card 1.JPG



40IVBa402B2 photo 1f.JPG

Boraginaceae
Cordia luteoclada # 468 (leaf). 237
 Fr 22
 40IV Cb2. #3
 8 sec

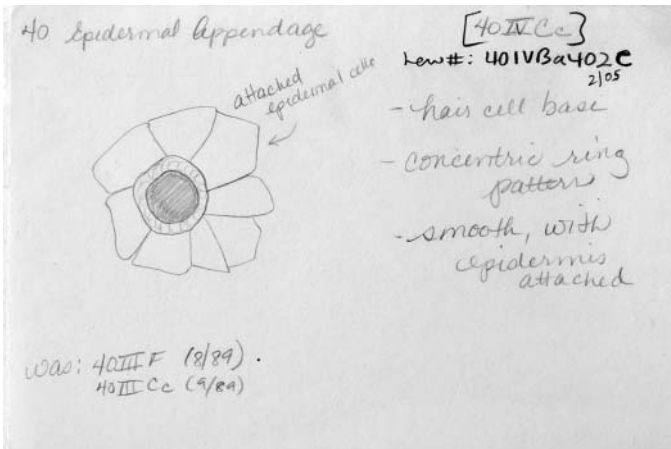
40IVBa402B2 photo 1b.JPG



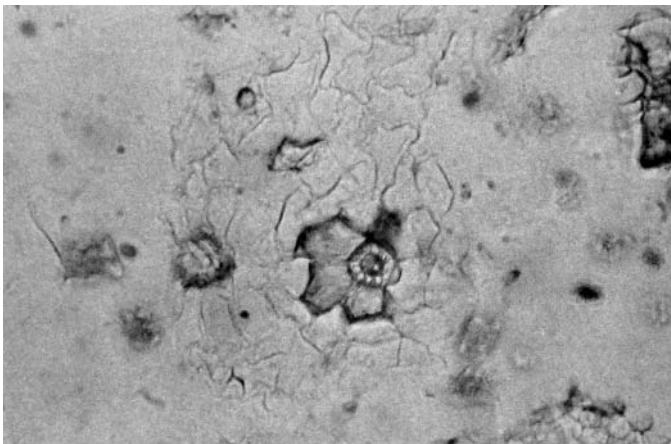
40IVBa4021B2 photo 2f.JPG

322
 Boraginaceae
Cordia luteoclada
 468 L
~~40IV Cb2~~
 40IV Cb2
 8

40IVBa402B2 photo 2b.JPG



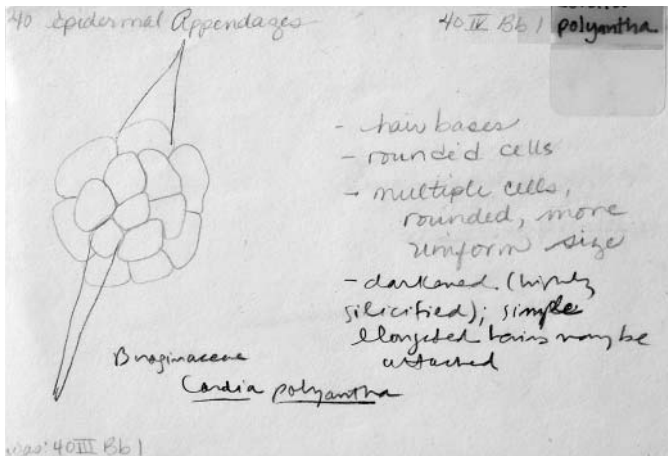
40IVBa402C card 1.JPG



40IVBa402C photo 1f.JPG

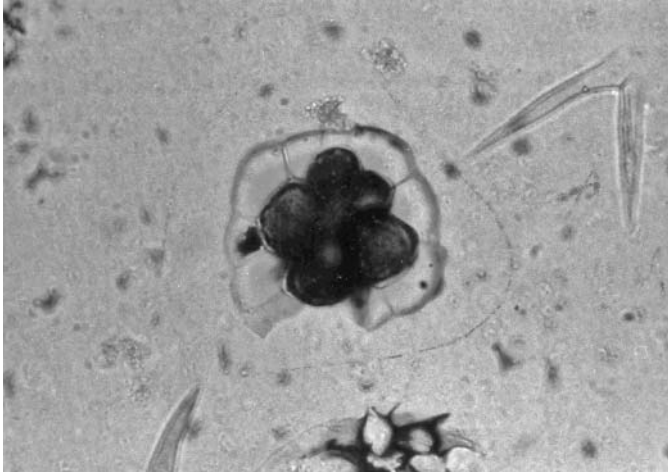
Torun Forest #3
 40IV Cc
 scale 1/5
 87R92-31

40IVBa402C photo 1b.JPG

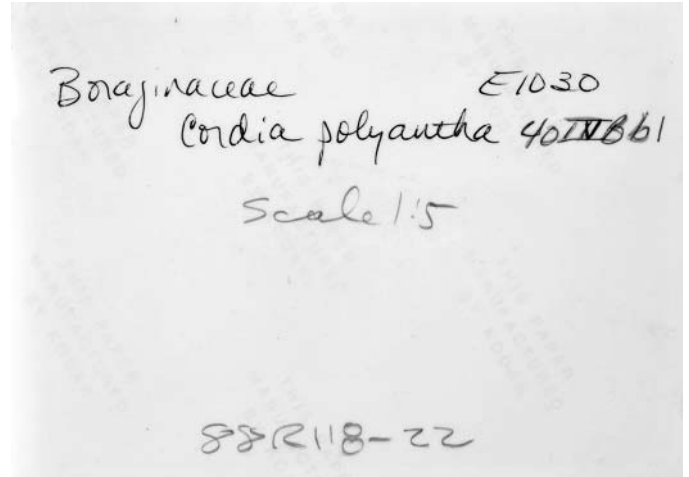


was: 40.IV Bb1

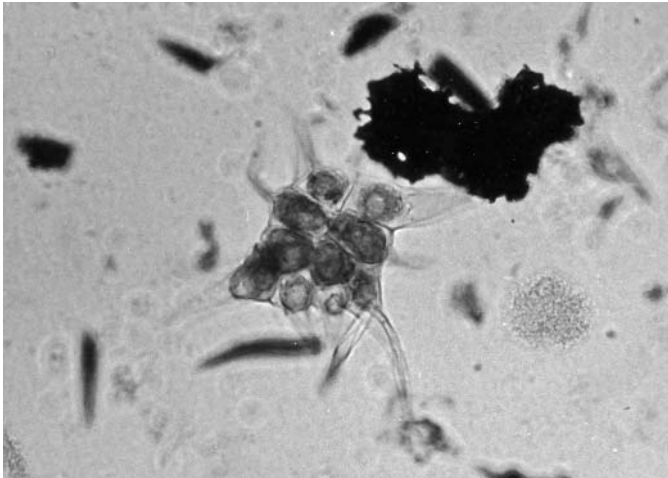
40IVBb1 card 1.JPG



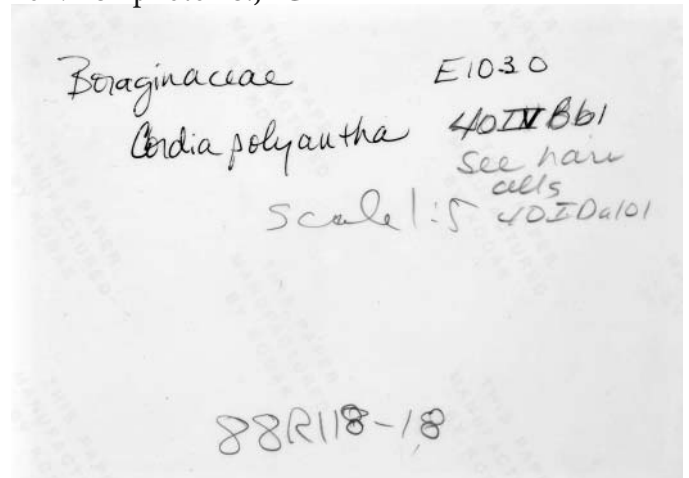
40IVBb1 photo 1f.JPG



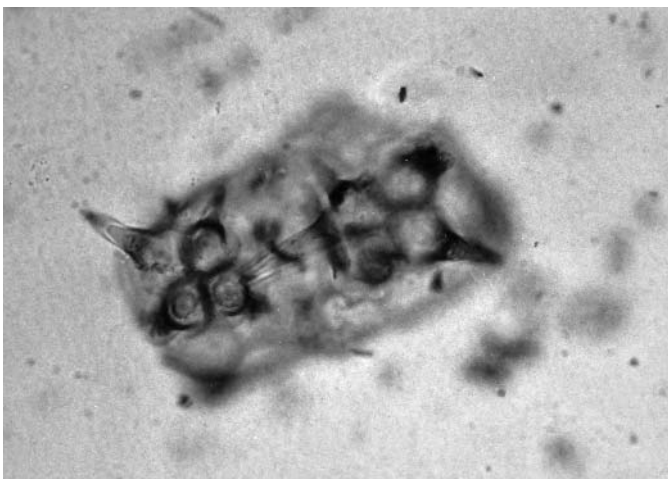
40IVBb1 photo 1b.JPG



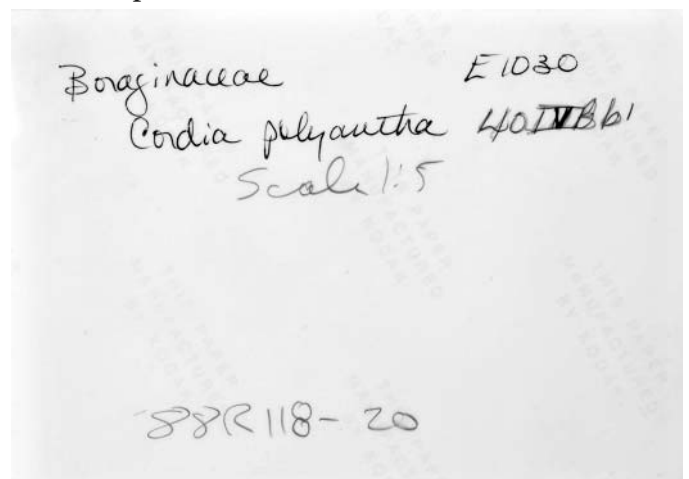
40IVBb1 photo 2f.JPG



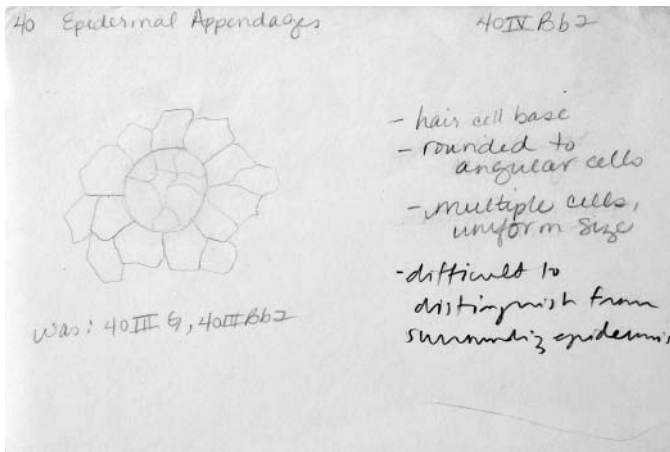
40IVBb1 photo 2b.JPG



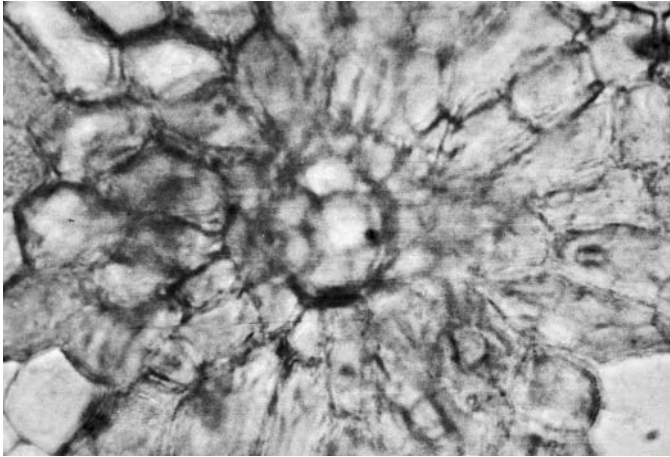
40IVBb1 photo 3f.JPG



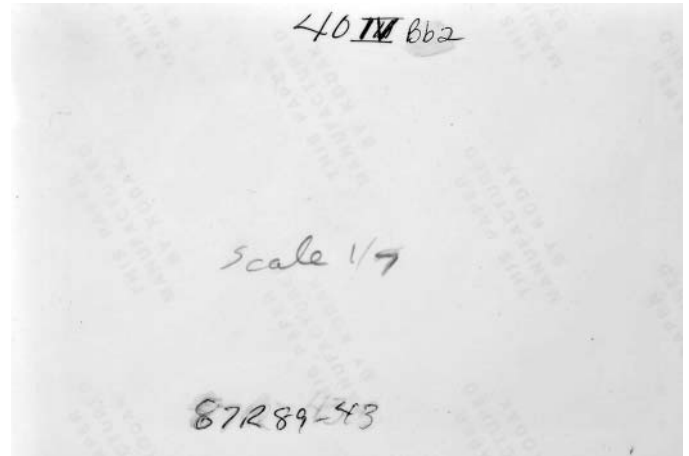
40IVBb1 photo 3b.JPG



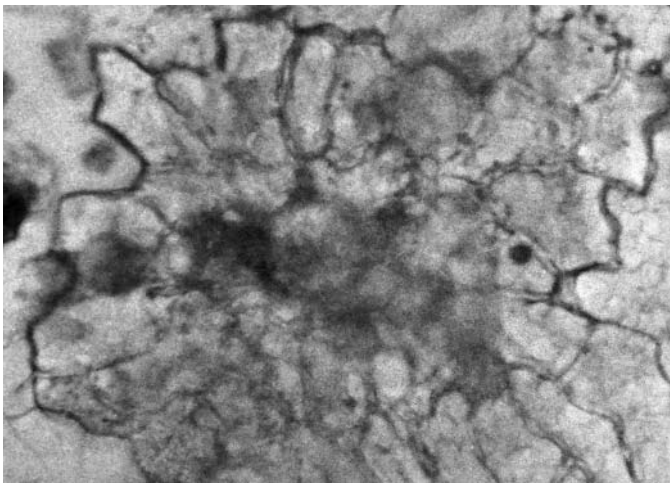
40IVBb2 card 1.JPG



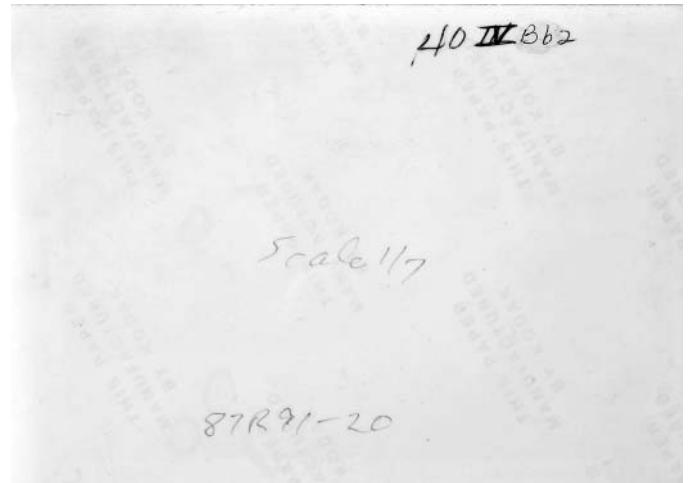
40IVBb2 photo 1f.JPG



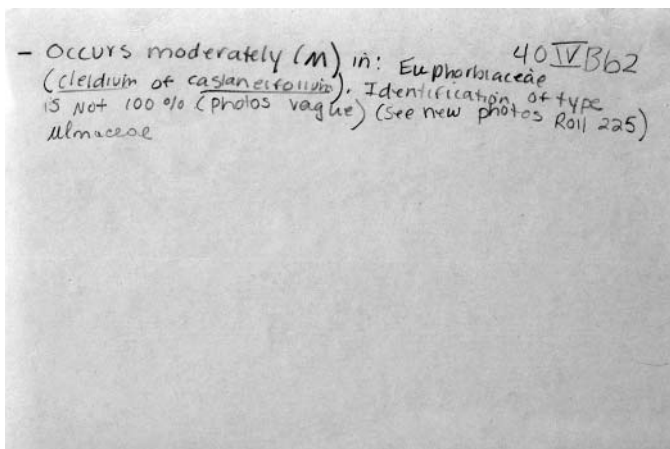
40IVBb2 photo 1b.JPG



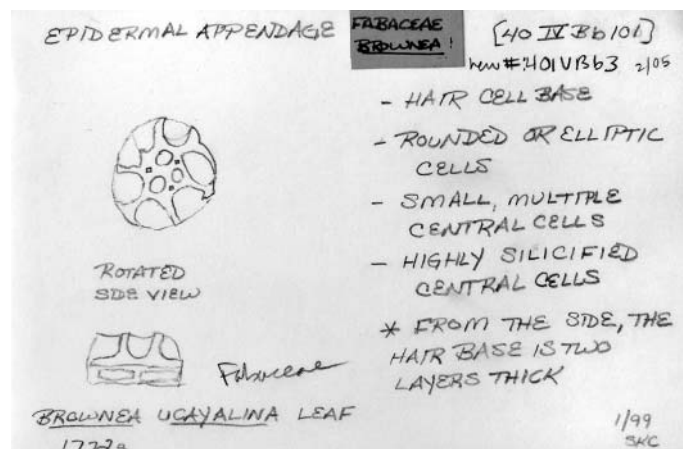
40IVBb2 photo 2f.JPG



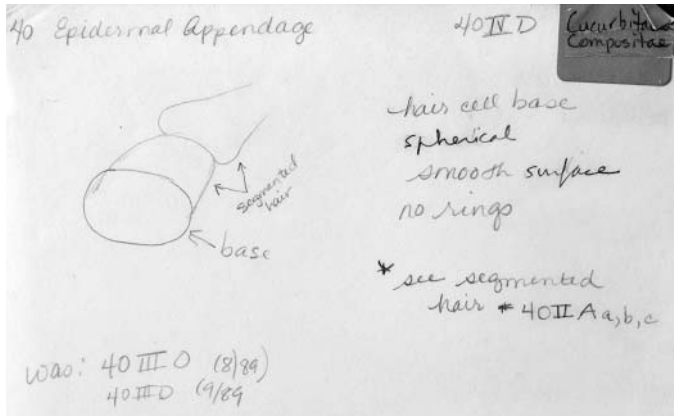
40IVBb2 photo 2b.JPG



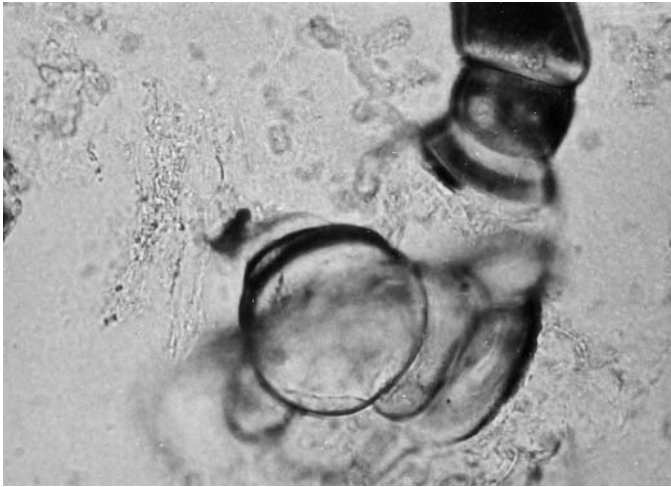
40IVBb2 card 2.JPG



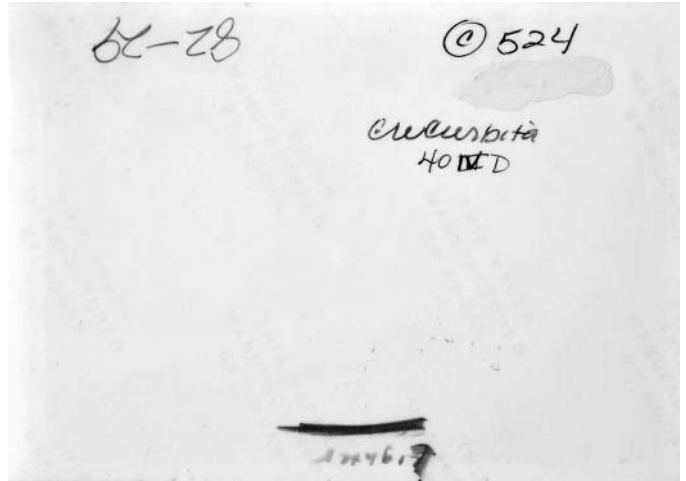
40IVBb3 card 1.JPG



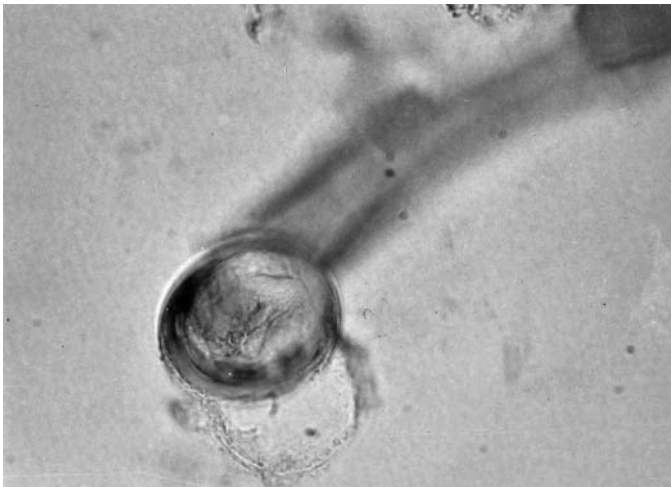
40IVD card 1.JPG



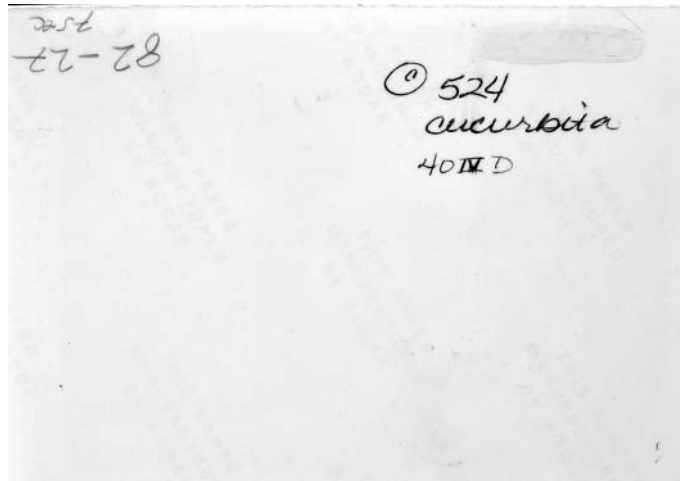
40IVD photo 1f.JPG



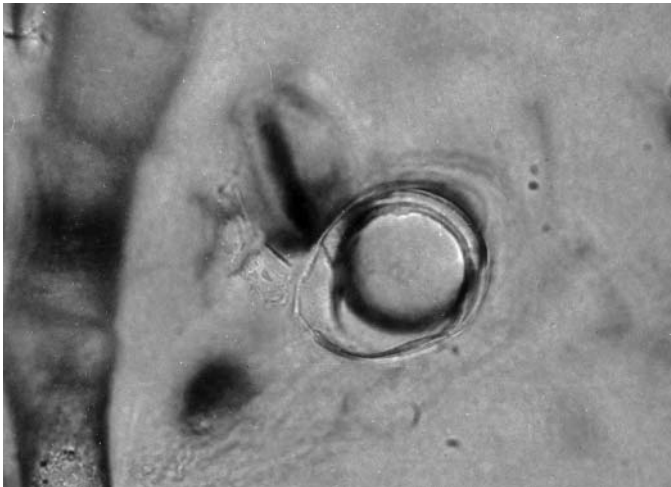
40IVD photo 1b.JPG



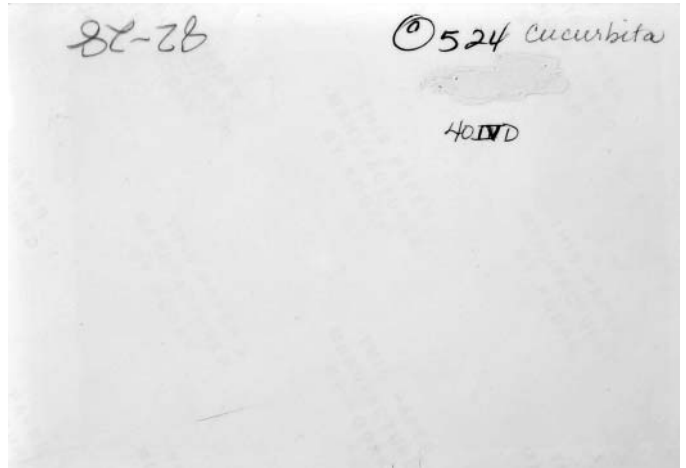
40IVD photo 2f.JPG



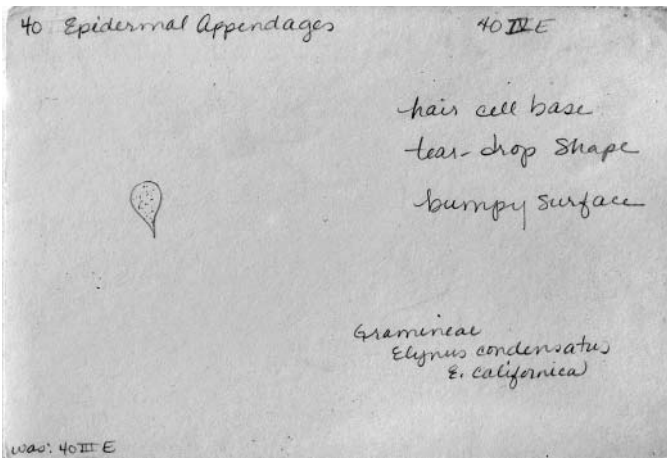
40IVD photo 2b.JPG



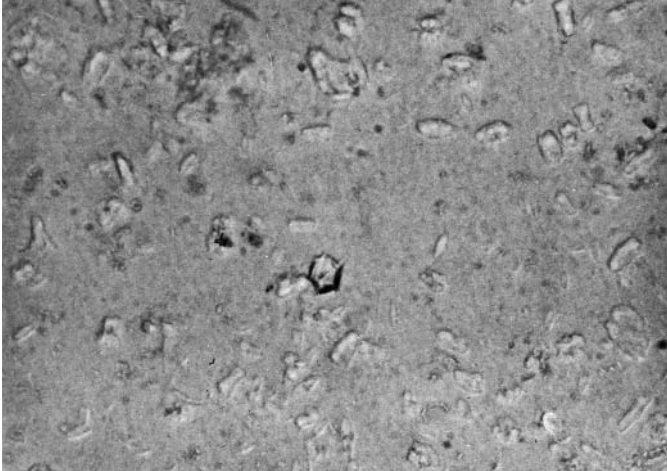
40IVD photo 3f.JPG



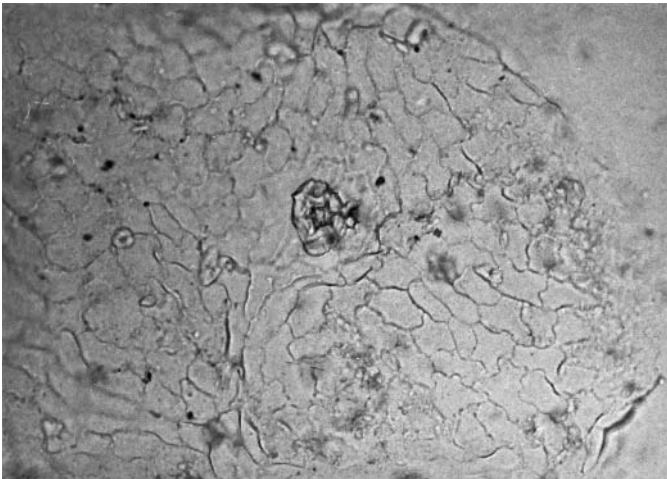
40IVD photo 3b.JPG



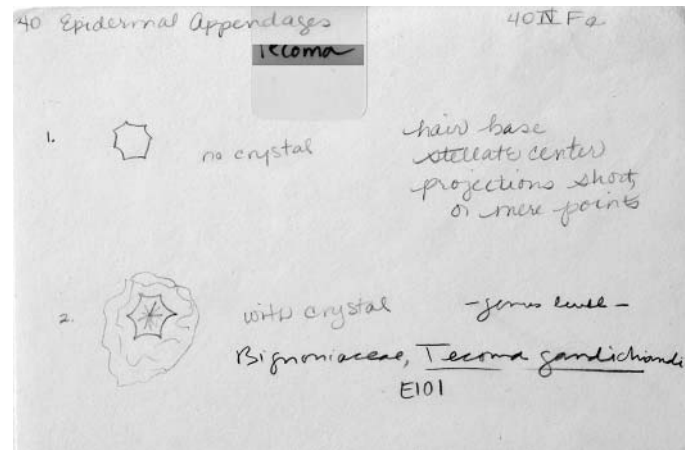
40IVE card 1.JPG



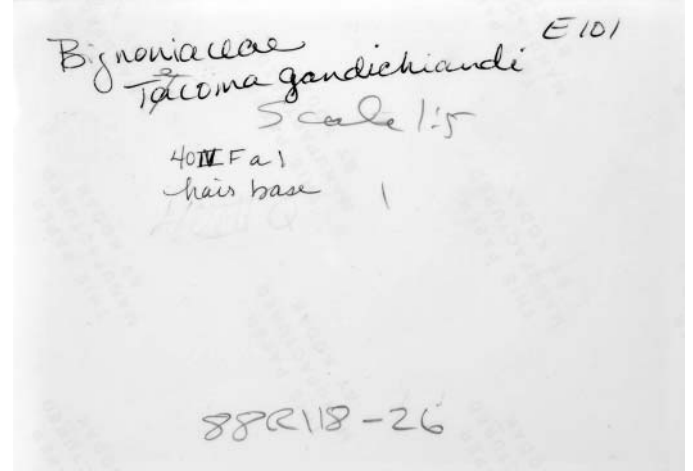
40IVFa photo 1f.JPG



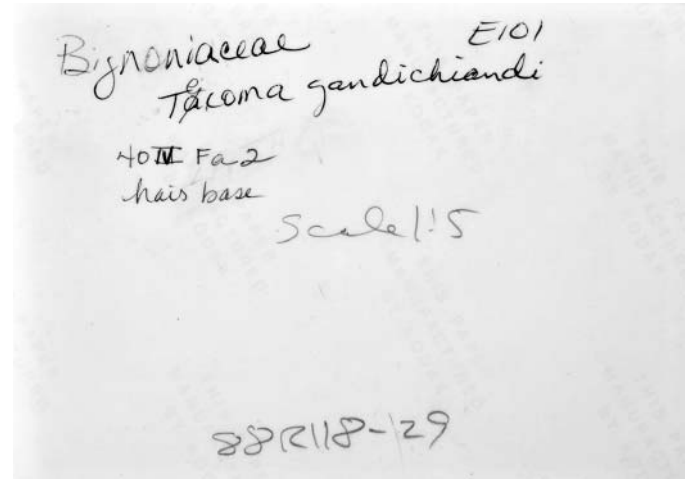
40IVFa photo 2f.JPG



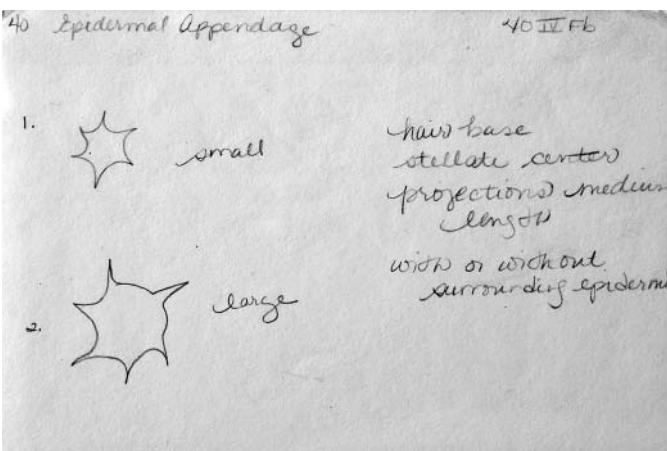
40IVFa card 1.JPG



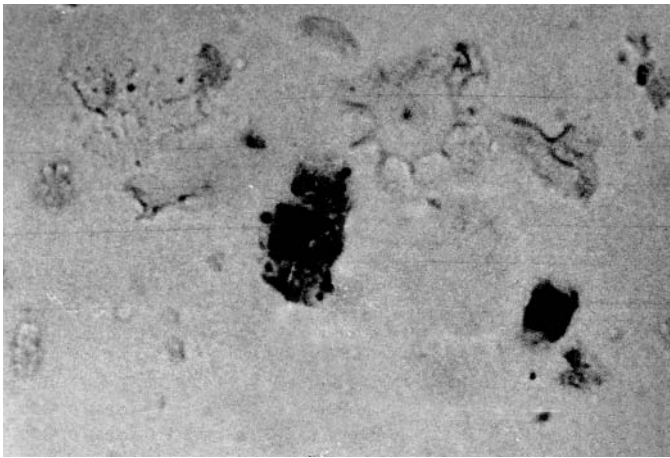
40IVFa photo 1b.JPG



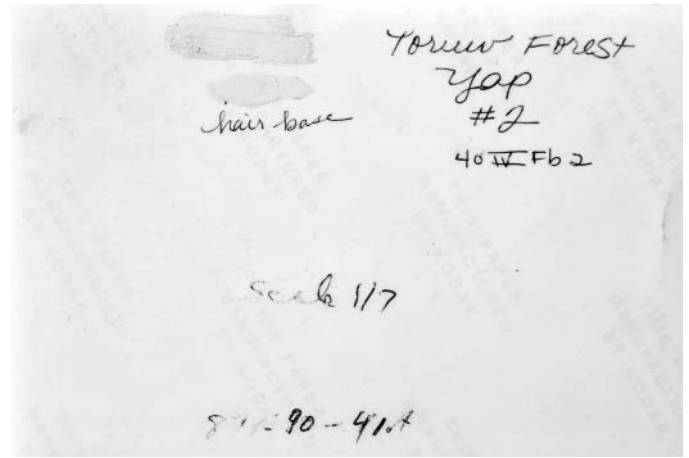
40IVFa photo 2b.JPG



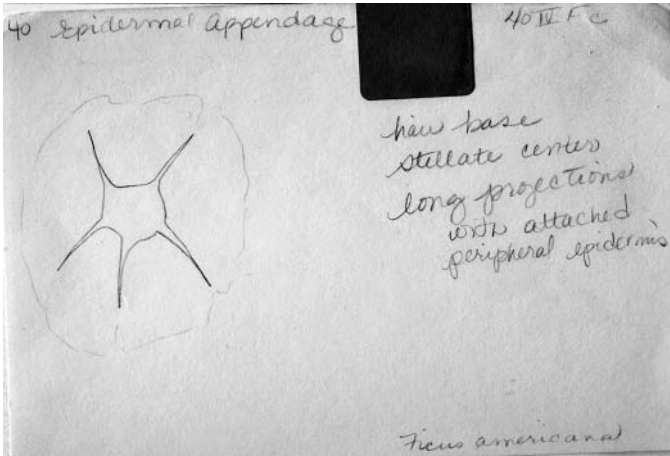
40IVFb card 1.JPG



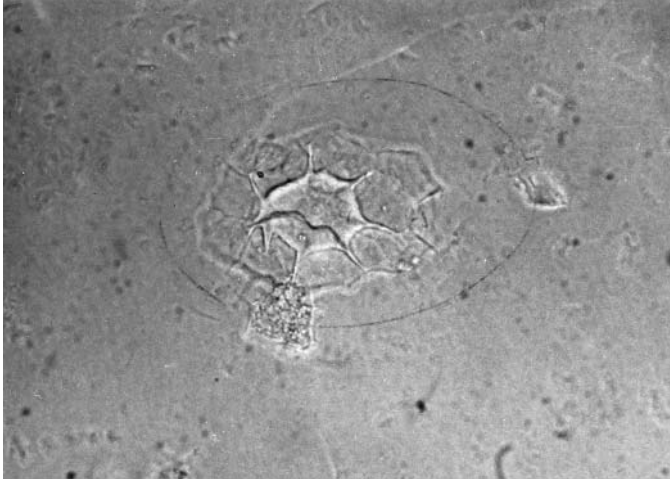
40IVFb photo 1f.JPG



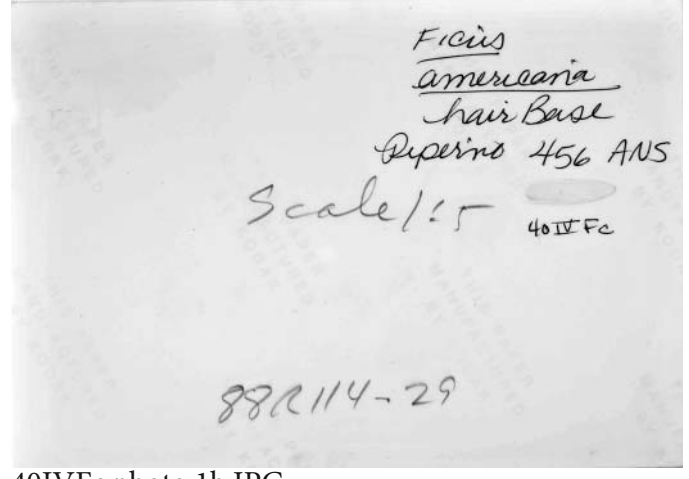
40IVFb photo 1b.JPG



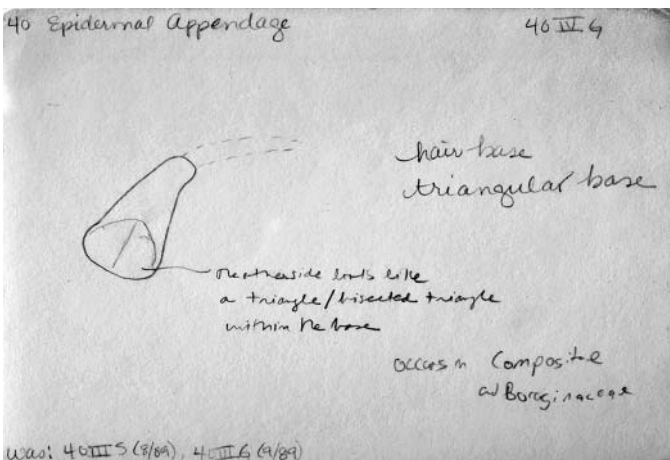
40IVFc card 1.JPG



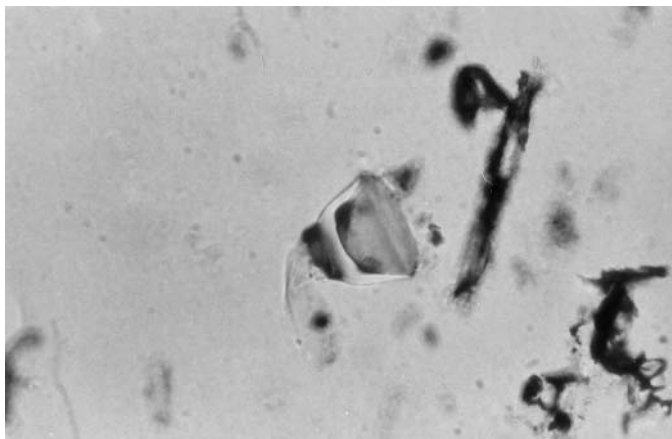
40IVFc photo 1f.JPG



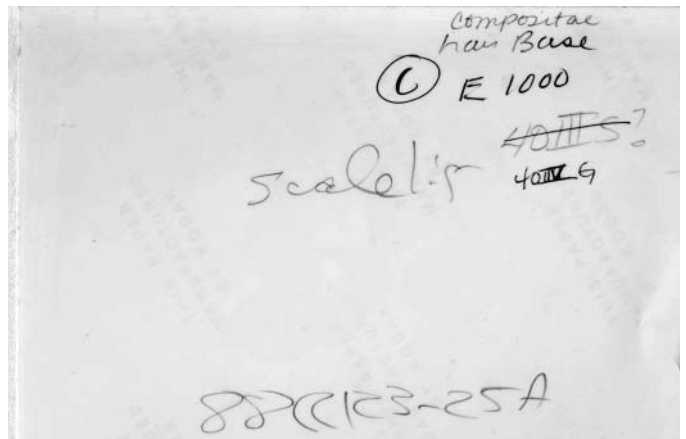
40IVFc photo 1b.JPG



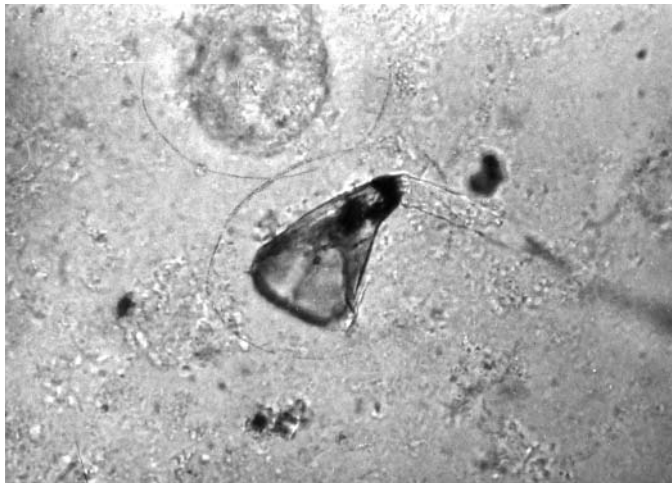
40IVG card 1.JPG



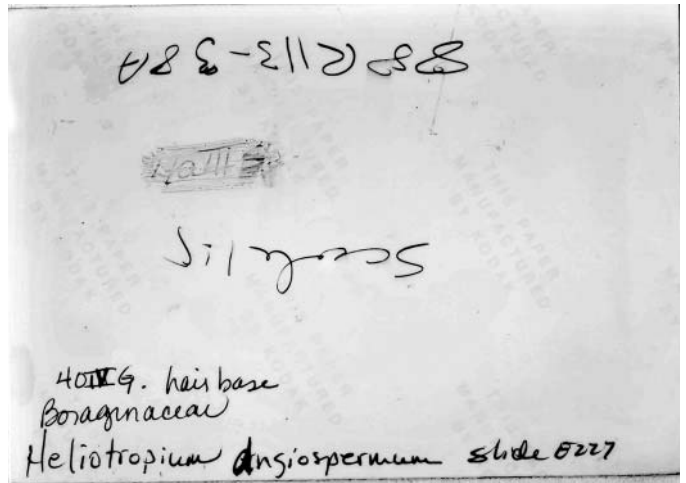
40IVG photo 1f.JPG



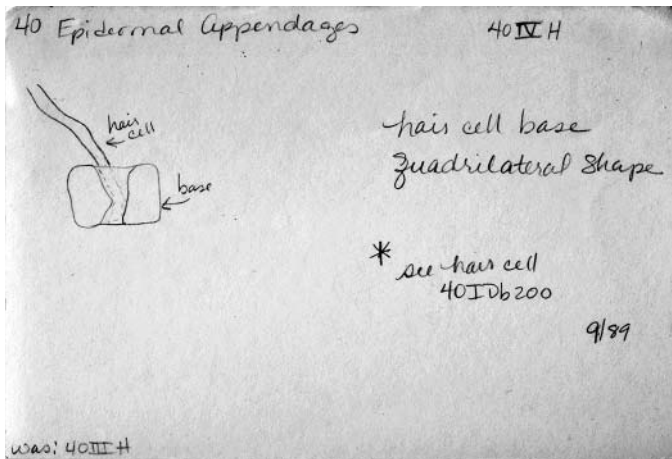
40IVG photo 1b.JPG



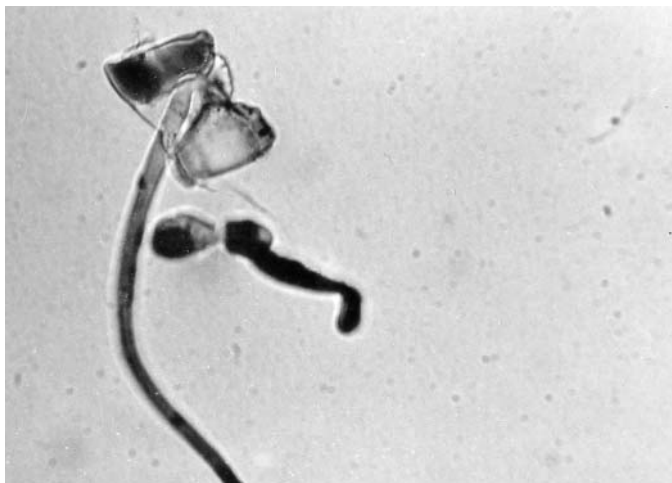
40IVG photo 2f.JPG



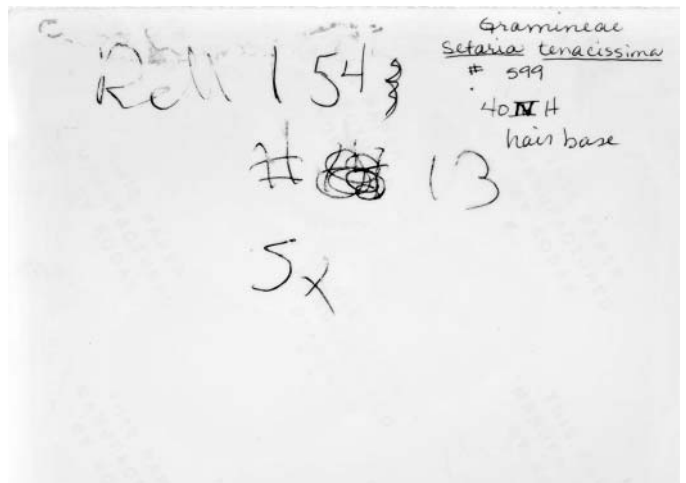
40IVG photo 2b.JPG



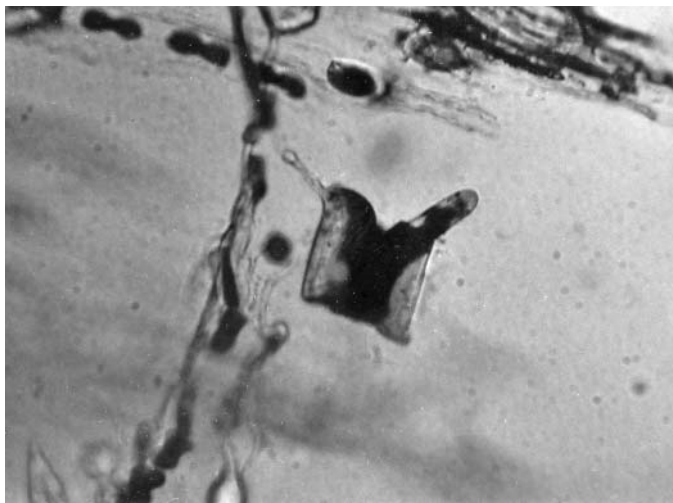
40IVH card 1.JPG



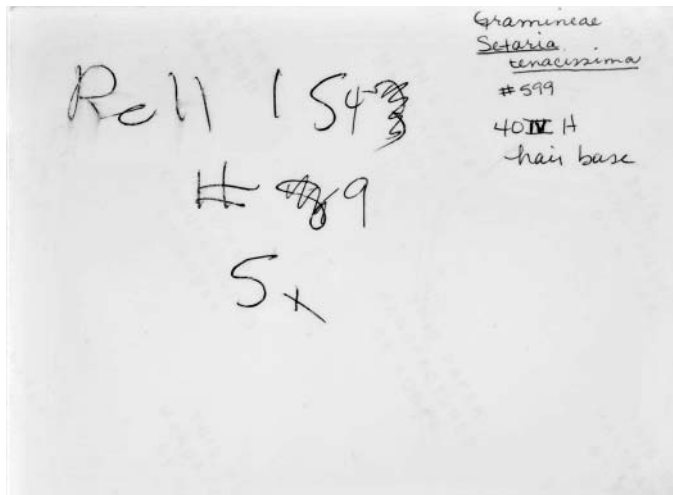
40IVH photo 1f.JPG



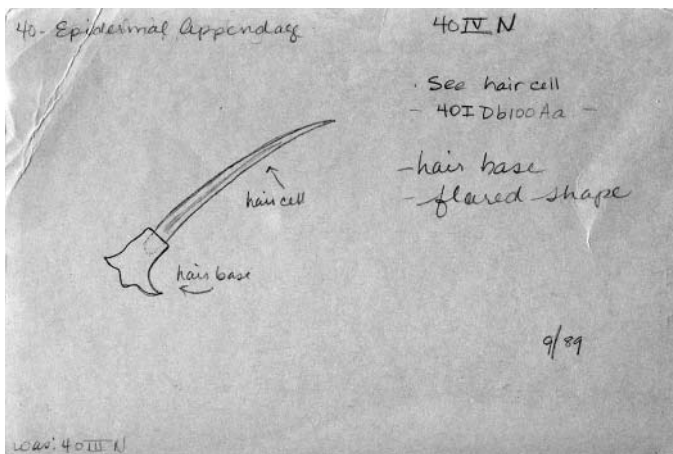
40IVH photo 1b.JPG



40IVH photo 2f.JPG



40IVH photo 2b.JPG



40IVN card 1.JPG