Patterning Techniques for Natural Dyes

An Iterative Approach to Making and Knowing

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The aim of the following exercises was to spend an extensive amount of time experimenting with various pattern-making techniques using natural dyes. The project is not aimed at a historical argument, nor is it an attempt at a reconstruction of historical techniques. Rather, it emphasizes the very act of making as a worthwhile activity in developing a certain form of knowledge that is not reducible to textuality. We would categorize this form of knowledge as sympathetic and exercisable through intuition.

Intuition?

We understand intuition as the ability to perform a particular set of tasks while partially distracted. This is a counterintuitive notion. Intuition often refers to the ability to perform a task to a high standard without relying on extensive instructions. We want to flip this definition on its head and imagine intuition as the ability to follow instructions as loosely as possible to get good enough results. To achieve this, one would perform many iterations freely rather than attempt to produce specific results through strict practice. This would require dispensing with any expectation of what a good outcome would be, participating in the process with the mind partially occupied with unrelated conversations, and interjecting the process with a series of unrelated activities.

And sympathetic knowledge?
Sympathetic knowledge would then be a kind of knowledge that is attached to this form of intuitive practice. Rather than allowing instructions to structure the practice of making, the development of sympathetic knowledge would require an active conversation with the materials at hand. Every step is assessed through its material effects and the subsequent steps are defined by the feedback from the material. In this way, no set of instructions could encapsulate the making process as the decisions made along the way fully rely on the materials' reaction to earlier decisions. Sympathetic knowledge then is the ability to act reflexively towards the materials' own reflexes.

Where the Project Began

Starting off from the imitation-damasked dyeing technique specified in Ms. Fr. 640 and the subsequent essay by Yuan Yi, who experiments with the author-practitioner's instruction and highlights the difficulties that arise from this method, our project aims to explore parallel techniques of resist dyeing used in this time period.

We combined this interest in resist dyeing with the techniques learned during Bertha Estrada Huipi’s and Mateo Rodriguez Estrada’s dye residency. We experimented with two of their dye baths and the techniques we learned in working with them to create a series of fabric samples of differing dye-resist techniques.

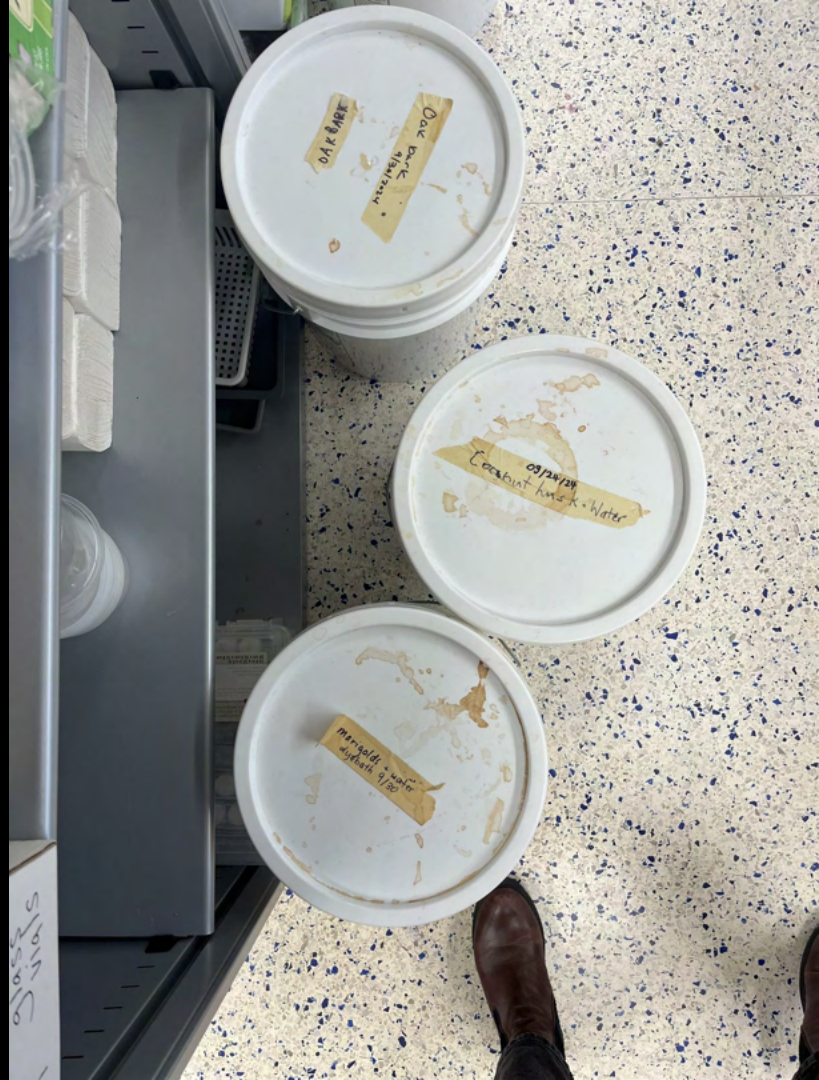
Resist Dyeing?

We experimented with two categories of resist dyeing. The first, block printing, encompasses several distinct methods, widely practiced across different regions. One approach involves applying a paste to remove dye from specific areas of fabric that have been pre-dyed. Another technique uses a mordant paste, which facilitates the absorption of dye only in the treated sections. Yet another method is to directly apply dye as a viscous paste.

Beyond block printing, other decorative methods rely on covering portions of the cloth – through pressure or a resist substance – before submerging it in a dye bath, allowing the dye to affect only the exposed sections. Collectively, these methods are classified as resist-dyeing techniques.

Preparatory steps

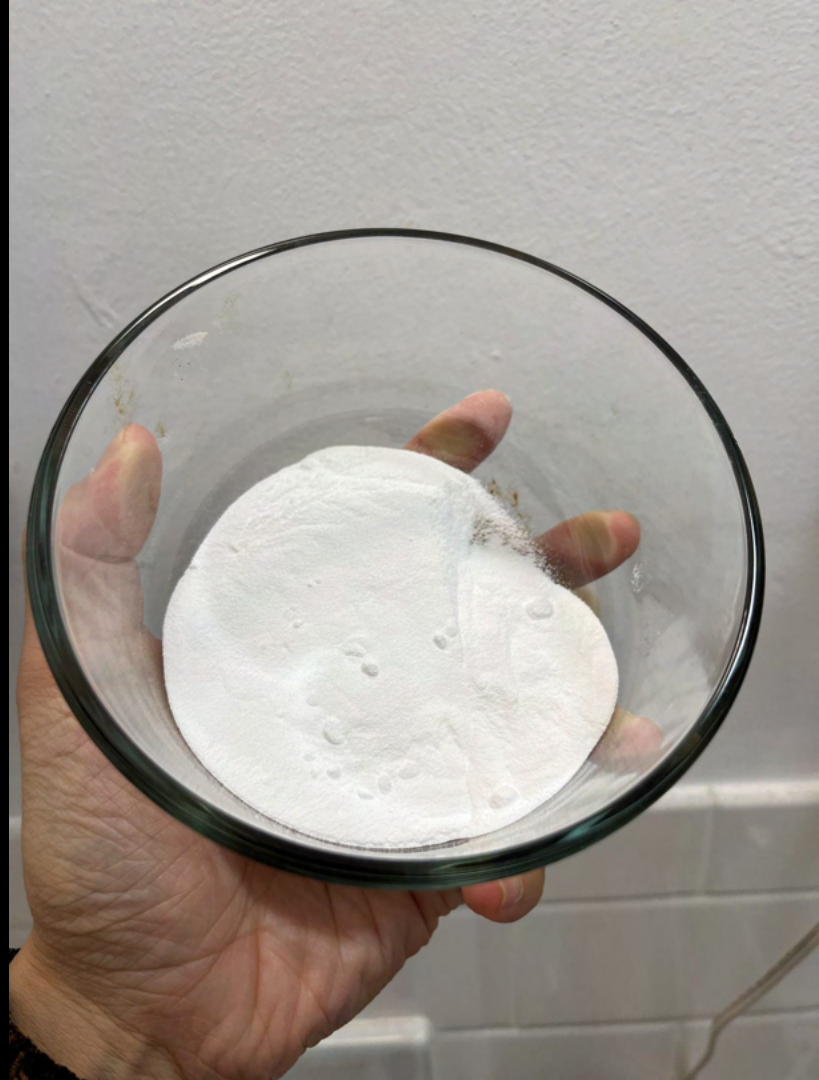
1. Selecting the most robust dye baths from Bertha and Mateo's residency. We chose cochineal and oak bark, pictured here.



Washing Soda

2. Using the field notes of Yuan Yi, we first made washing soda, an ingredient needed to scour cloth in order to remove dirt and grease accumulated in the course of manufacturing. This allows for an even penetration of dyes.

Washing soda is made by baking baking soda, drawing upon a recipe on this website. We baked baking soda in a Pyrex bowl for an hour at 400 degrees Fahrenheit, which transformed into washing soda. After this process the substance was different in texture – it was much softer and felt like powdered sugar before being sifted.

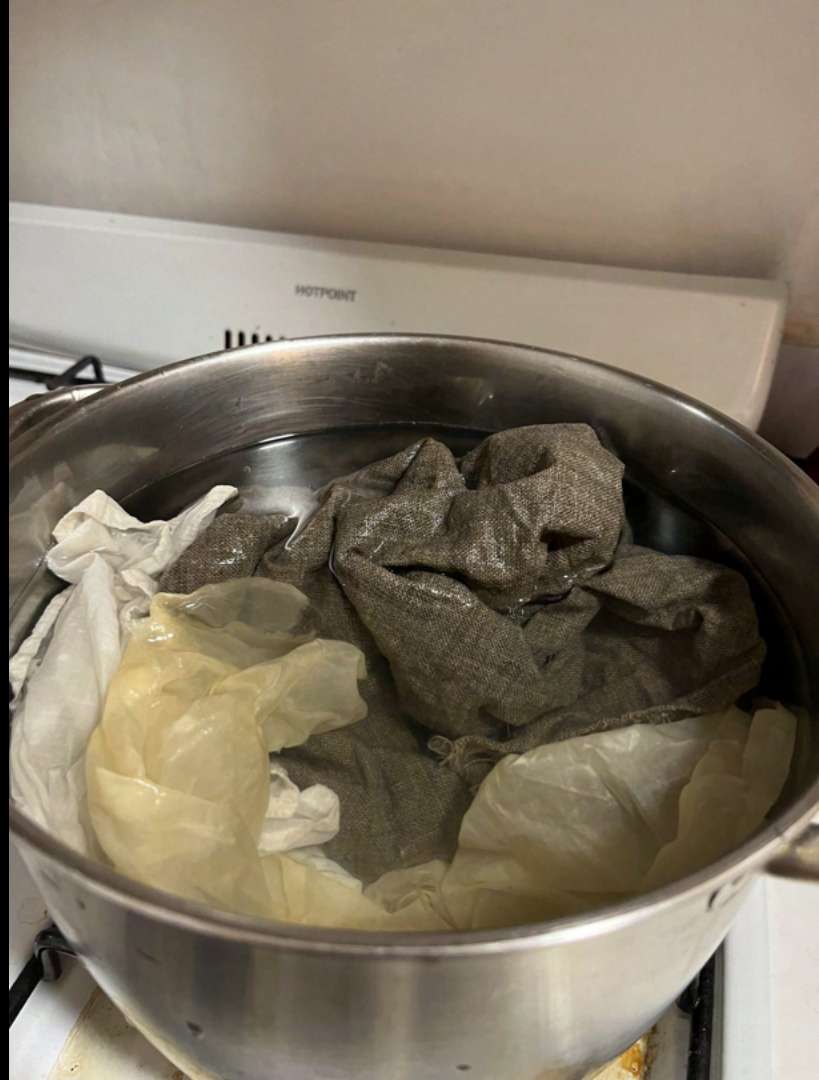


Washing and Scouring Cloth

3. We decided to use three different types of fabrics, linen, cotton, and silk. To wash the cotton and linen, we filled a stainless steel pot with 2.5 gallons of tap water so that a minimum of 0.5 gallons of water was used per one ounce of fabric. We added 3 tsp of laundry detergent plus 12 tsp of washing soda. To wash the silk, we rinsed it in fresh, warm water at least 6 times (Mascall, 1583, 112).

Washing Cloth, Cont.

We let the scouring fabrics simmer for 3 hours and removed them from the heat to cool overnight with fresh, warm water. The water got incredibly dark, and throughout the night the apartment smelt like boiling wood. Hot water had to be continually added so there was enough to boil the material. We realized that even in this process exact measurements were redundant, as the most important element was that the cloth was completely immersed in water, not the exact ratio of water to fabric. The next morning the fabric was rinsed a few more times and then hung to dry (Mascall, 1583, 113).



Block Printing

The use of hand-carved wooden blocks for block printing is likely the oldest technique for applying dyes, typically in paste form, to specific areas of a textile. In various methods from Pakistan and India, coloring materials were extracted, finely ground into a powder, then combined with a binder or adhesive before being applied to the fabric. Once the paste dried in the sun, the cloth was thoroughly washed to eliminate any excess dye (Hann, 2021, 132-134).

We experimented with two different binders: egg yolk and gum arabic.

… and we experimented with two different pigments: cochineal lake pigment and yellow ochre pigment

Mulling Process

We started with pigment and binder, then added water while grinding pigment on a flat surface and a hard glass base that we used as a muller.

Image: cochineal lake pigment with egg yolk

Stamping Process

Once the substance had the right consistency (that is, thick and similar to paint), it was applied to a wooden stamp with a brush

We tested different amounts of paint on the stamp and different holding length and pressure

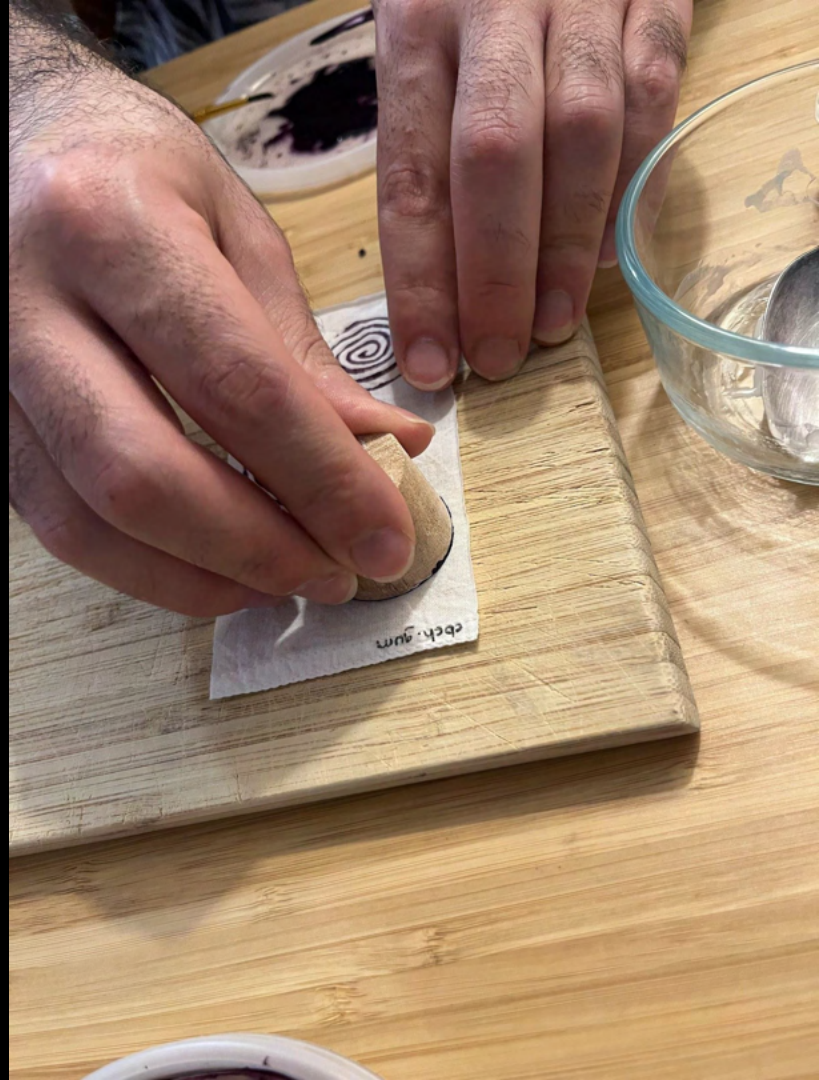


Image: cochineal lake pigment with egg yolk stamp

Image: cochineal lake pigment with gum arabic stamp

Image: different iterations of this process.

We repeated the same trials with yellow ochre pigment, using both egg yolk and gum arabic as the binder.

Image: yellow ochre with egg yolk.

Image: yellow ochre with gum arabic

Observations

After multiple experiments with the two binders, it became clear that the egg yolk has a much shorter painting window as it dries very quickly. The gum arabic on the other hand, requires more water and consistency check to arrive at an adequate thickness to paint onto the wooden block.

Tie Resist Dyeing

Tie-and-dye is a method where dye is applied selectively to certain parts of a fabric, while other areas are shielded by tightly tying or stitching the material, preventing the dye from penetrating. This technique exhibits diverse variations across the world, with prominent examples originating in regions such as Indonesia, India, Pakistan, West Africa, and Japan. The spread of these localized styles to other parts of the world can likely be attributed to historical trade networks or colonial interactions (Hume, 2013).

Using cotton string, a tie-and-dye resist method was next employed on each of the different fabrics (cotton, silk, and linen).

Wax Resist Dyeing

Wax is a common resist material, widely used in various parts of Asia, particularly in Java, Indonesia, which is renowned for its expertise in batik production. Batik, a resist-dyeing technique, involves applying wax to fabric by hand-painting it onto the surface. Once the fabric dries, the wax is removed through boiling or scraping (Robinson, 1969, 286).

We decided to test this technique using both 100% beeswax and an ordinary wax candle found at a convenience store.

Using a wooden chopstick, we applied the wax onto our three different fabrics, using the same swirl pattern as our wooden stamp.


candle

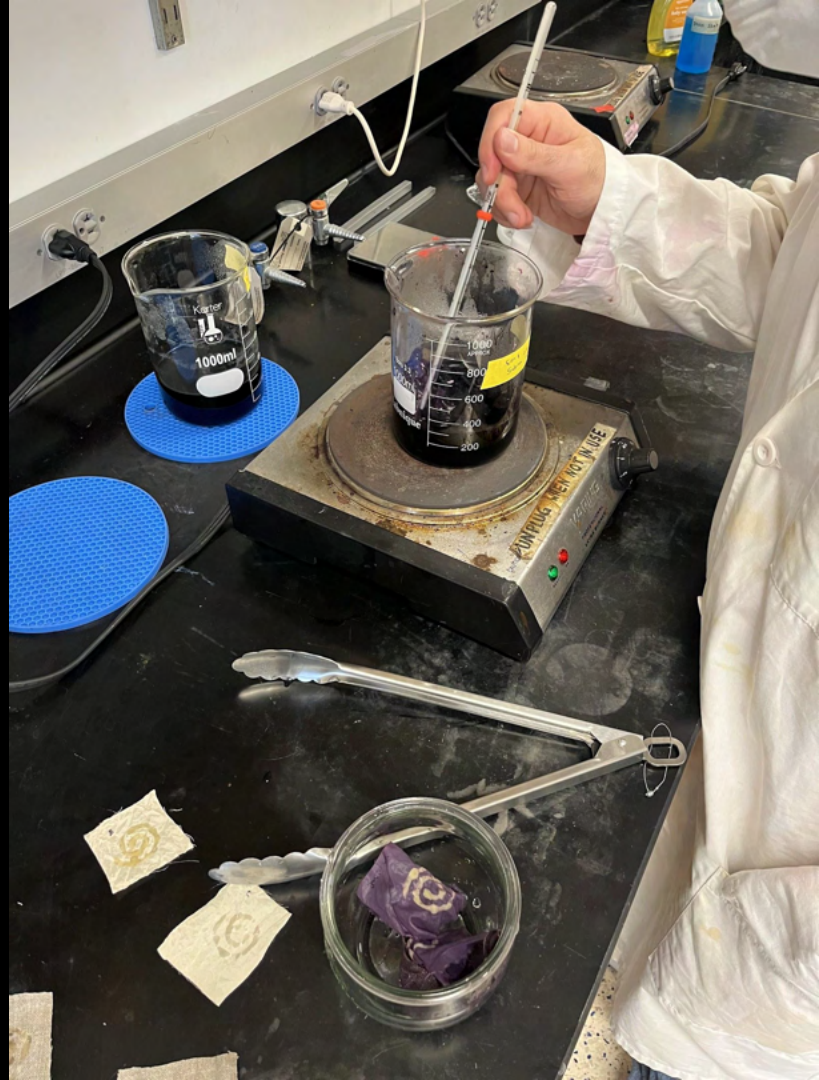
Dyeing Process

Using the same techniques as the dye residency, we soaked each cloth in the dye bath, each with 1 tablespoon of iron oxide mordant, at 60-70 degrees Celsius (below boiling), for 20 minutes.

Each dye resist method, used on three types of fabrics, was then put into two different dye baths.

Cochineal Dye Bath

Oak Bark Dye Bath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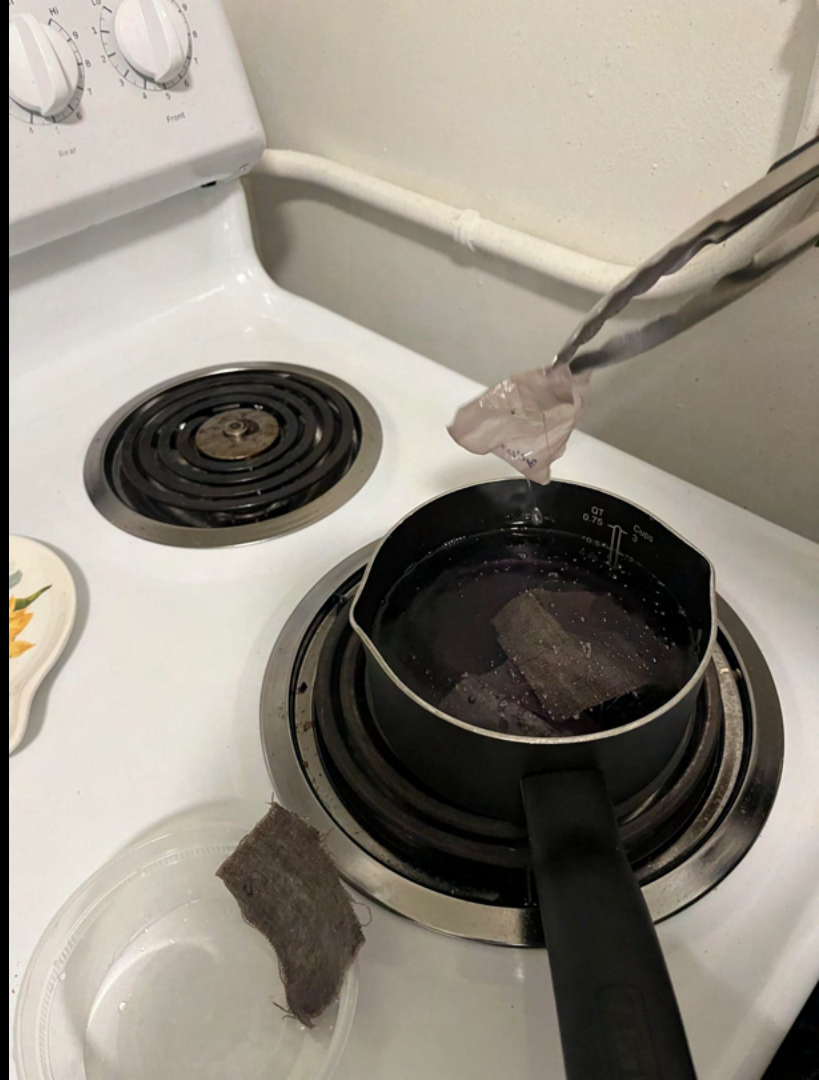
UNPLUG WHEN NOT IN USE

We changed the end dye process slightly, based on the literature on dye-resist techniques, by allowing the fabrics to sit in the dye baths, in closed containers, for more than five hours (in this case, overnight). We hoped this would ensure the staining of the dyes so that our primary variable, the dye-resist techniques, would show.

Wax Dye Technique End Step

We removed the wax from the three different fabrics by boiling off the wax residue.

Unfortunately, the dye itself came off with both forms of wax, resulting in a very faint dye-resist result.



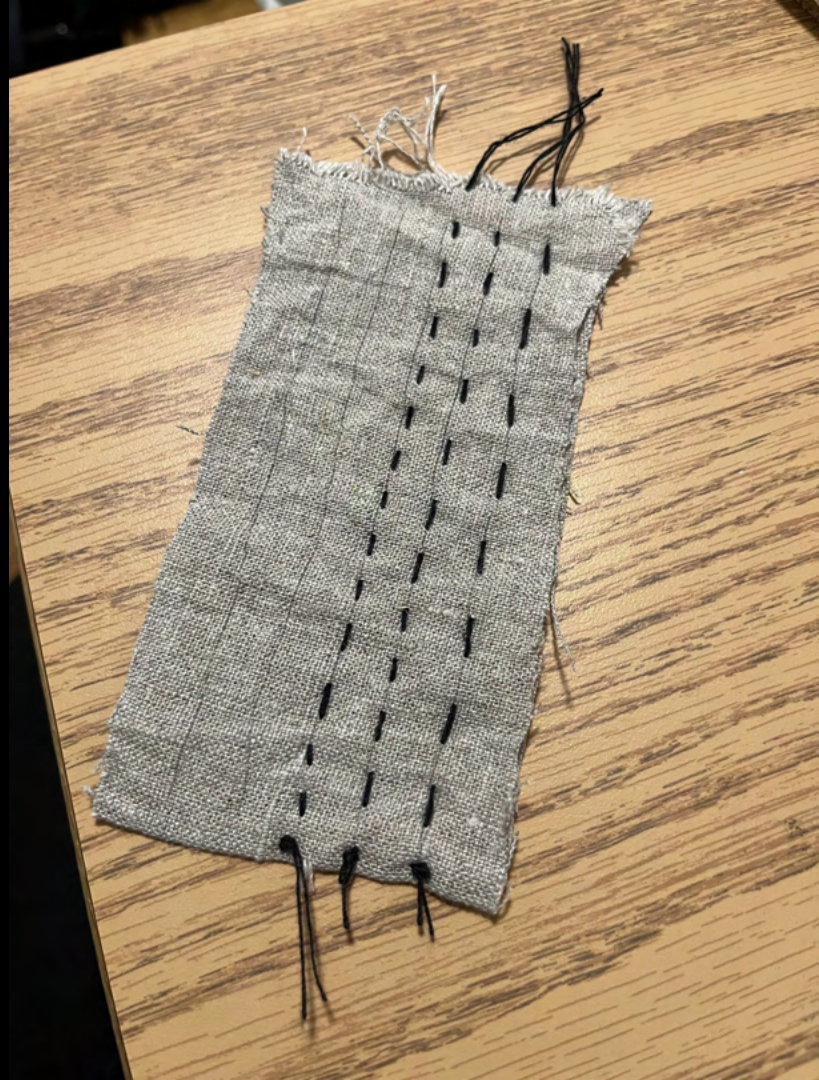
The heated water used to remove the wax from the cochineal dye baths can be seen here, colored purple.

Sew and Compression Resist Dyeing

Shibori (a traditional resist-dyeing technique from Japan) and *tritik* (the counterpart of Indonesia) produce intricate patterns by manipulating fabric through folding or compressing techniques before dyeing. After shaping the fabric into a specific design and securing it with string or two flat surfaces, it is immersed in a dye bath. The resist areas, protected by the binding materials, remain untouched by the dye. There are various s*hibori* techniques, such as *kumo*, which creates patterns by binding the fabric with thread, and *itajime*, which forms geometric patterns by clamping folded fabric between two flat surfaces (Robinson, 1969, 259.)

A simple running stitch was used for the sew resist dyeing technique on a folded piece of fabric. The stitch began at the fold and ended at the edge of the fabric. Different stitch lengths were created to ensure a varying pattern in the end result.

Shown here is the linen example with pre-drawn lines.



Each double-stranded string was then pulled, creating different fold patterns between each stitch. Each fold was compressed by hand as the strands were pulled to their maximum tightness without breaking the cotton strings. Loop knots were then tied at the base of each strand.

This was repeated on our three different fabrics: cotton, linen, and silk.

Various patterns were created to test this resist technique, including a swirl pattern. 100% cotton string was used for all sew methods.

Pictured here are different sew and compression resist dye techniques performed on different fabrics before they were put into the dye baths. We also tested two cotton swatches that had been previously dyed with cochineal and oak bark to test out a double-dye method.

For the compression technique, we used two pieces of cardboard wrapped in cotton string and folded the cloth into stacked triangles.

We increased the amount of mordant since the iteration done in the lab a few days prior was fainter than we had hoped.

The same dye bath technique was used during the residency and during our days in the lab. Each test fabric was soaked in a 60-70 degree Celsius cochineal dye bath for 20 minutes, then left to soak overnight in a closed container.

The next morning, each process was washed in cold water until the water ran clear.

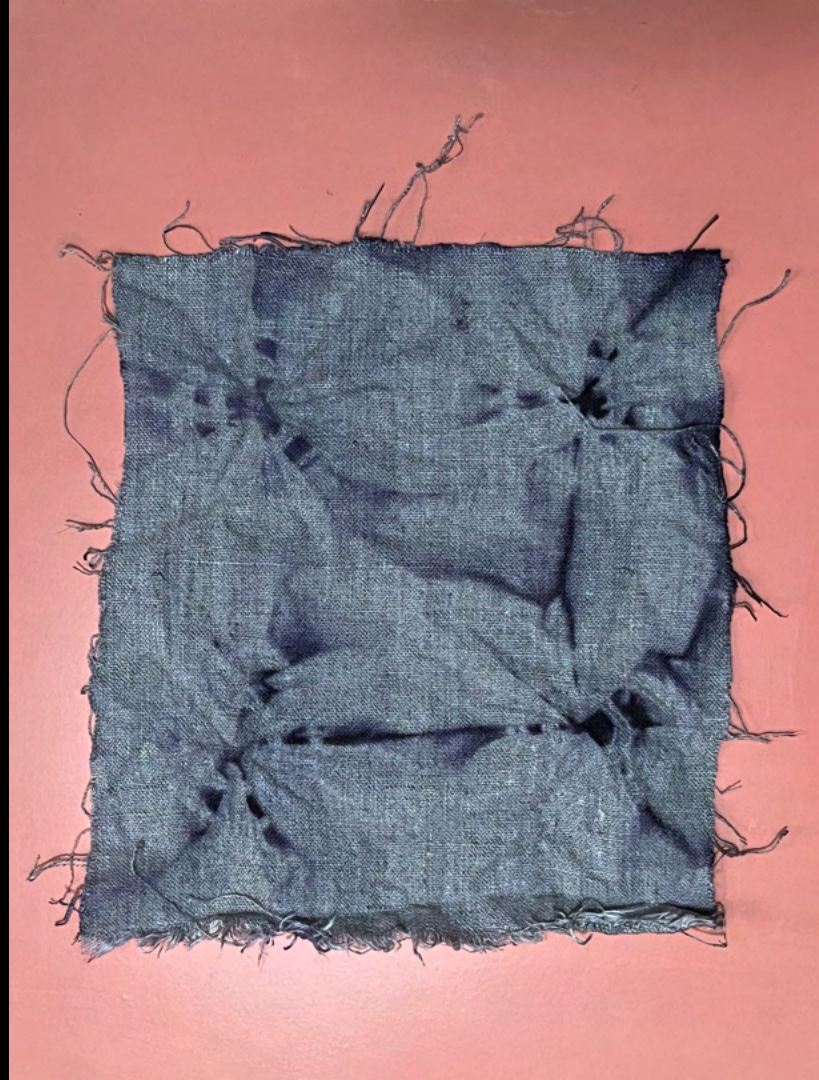
Results: Pre Iron

Material: linen
Dye: cochineal
Mordant (iron oxide): 4 tbsp
Patterning Technique: sew resist

Material: cotton
Dye: cochineal over previously dyed oak bark
Mordant: 4 tbsp
Patterning Technique: sew resist (in swirl)

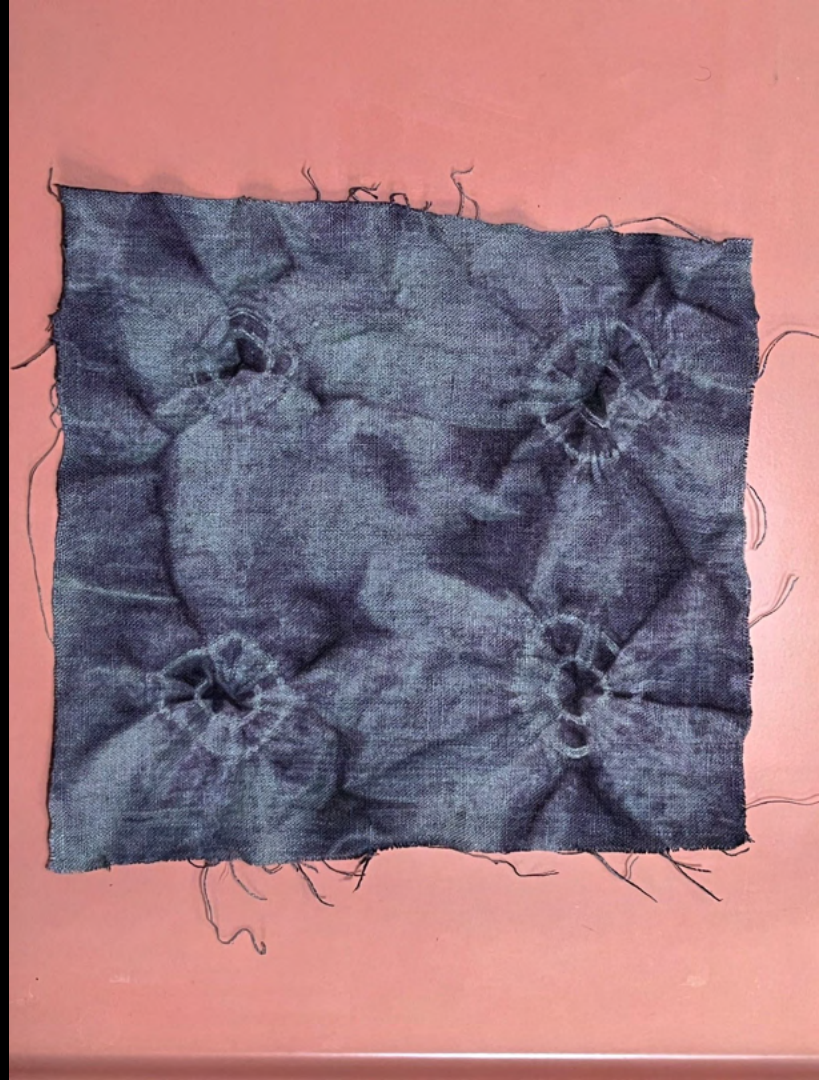
Up close you can see part of the string that was used to sew before it was extracted. Holes from the needle are still apparent in the fabric.

Material: linen
Dye: cochineal
Mordant: 2 tbsp
Patterning Technique: tie resist
Image: front of cloth



Material: linen
Dye: cochineal
Mordant: 2 tbsp
Patterning Technique: tie resist
Image: back of cloth

Material: linen
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: tie resist
Image: back of cloth



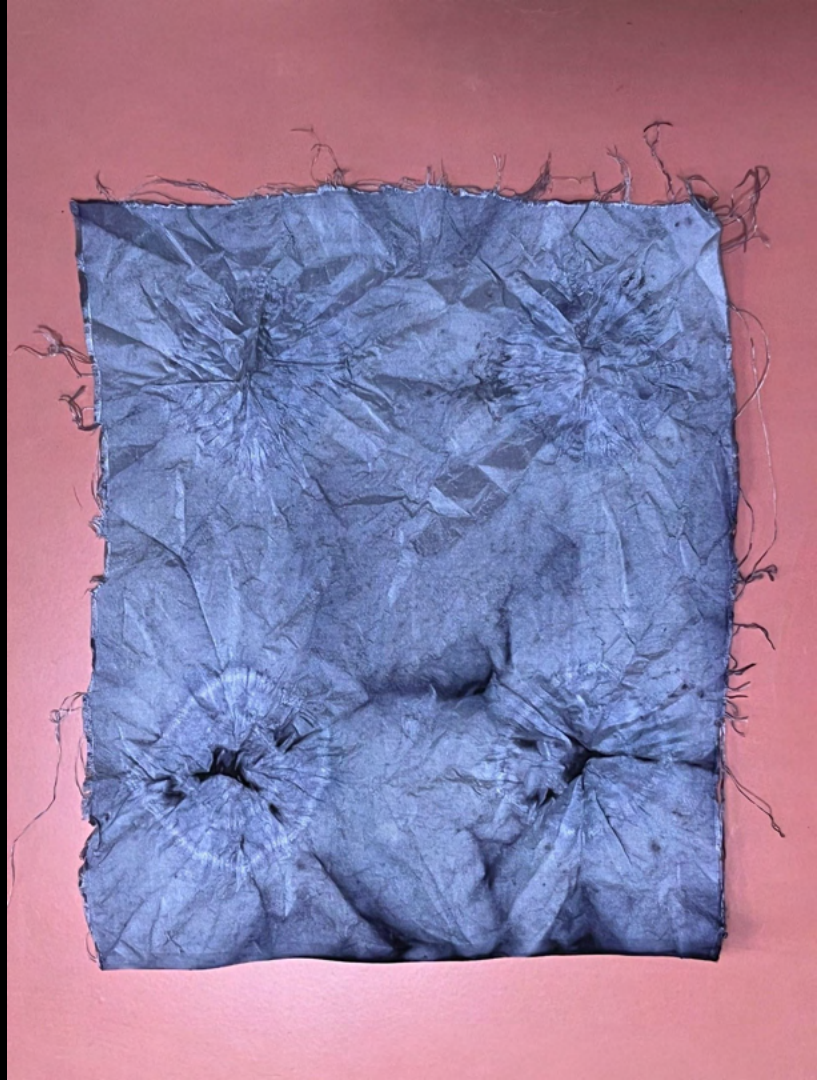
Material: linen
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: tie resist
Image: front of cloth

Material: cotton
Dye: oak bark
Mordant: 4 tbsp
Patterning Technique: tie resist
Image: front of cloth

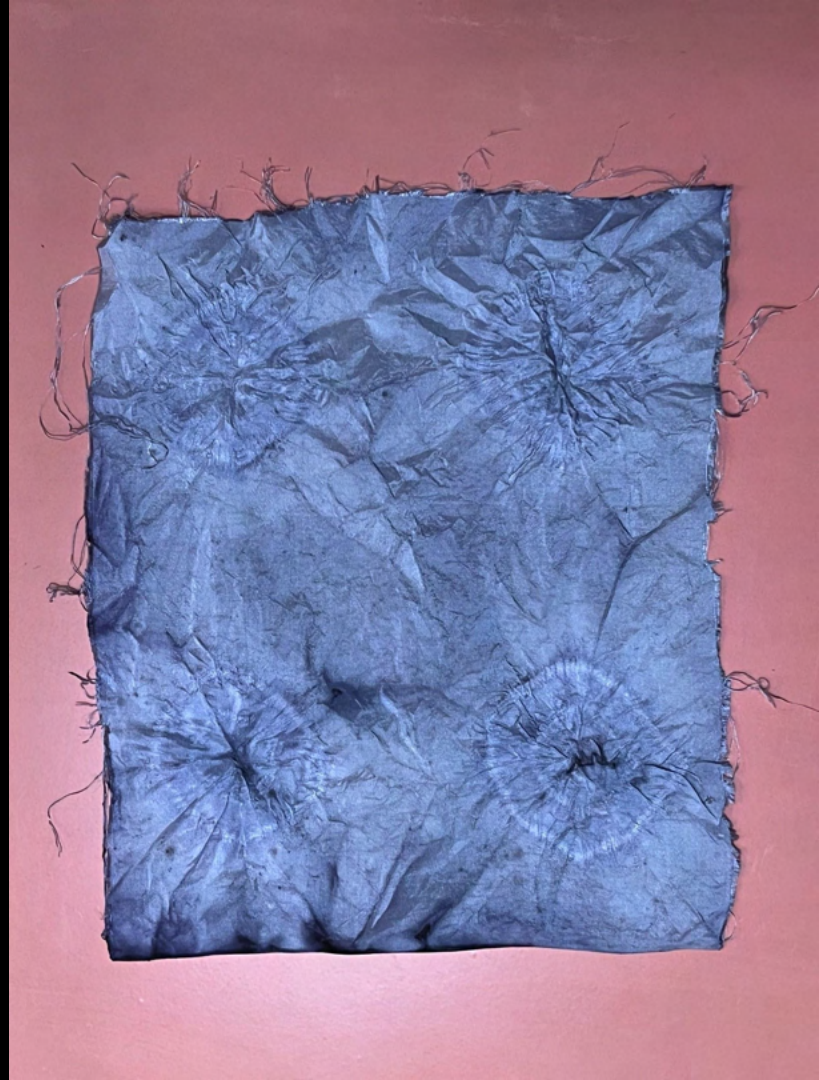
Material: cotton
Dye: oak bark
Mordant: 4 tbsp
Patterning Technique: tie resist
Image: back of cloth

Material: silk
Dye: oak bark
Mordant: 4 tbsp
Patterning Technique: tie resist
Image: front of fabric

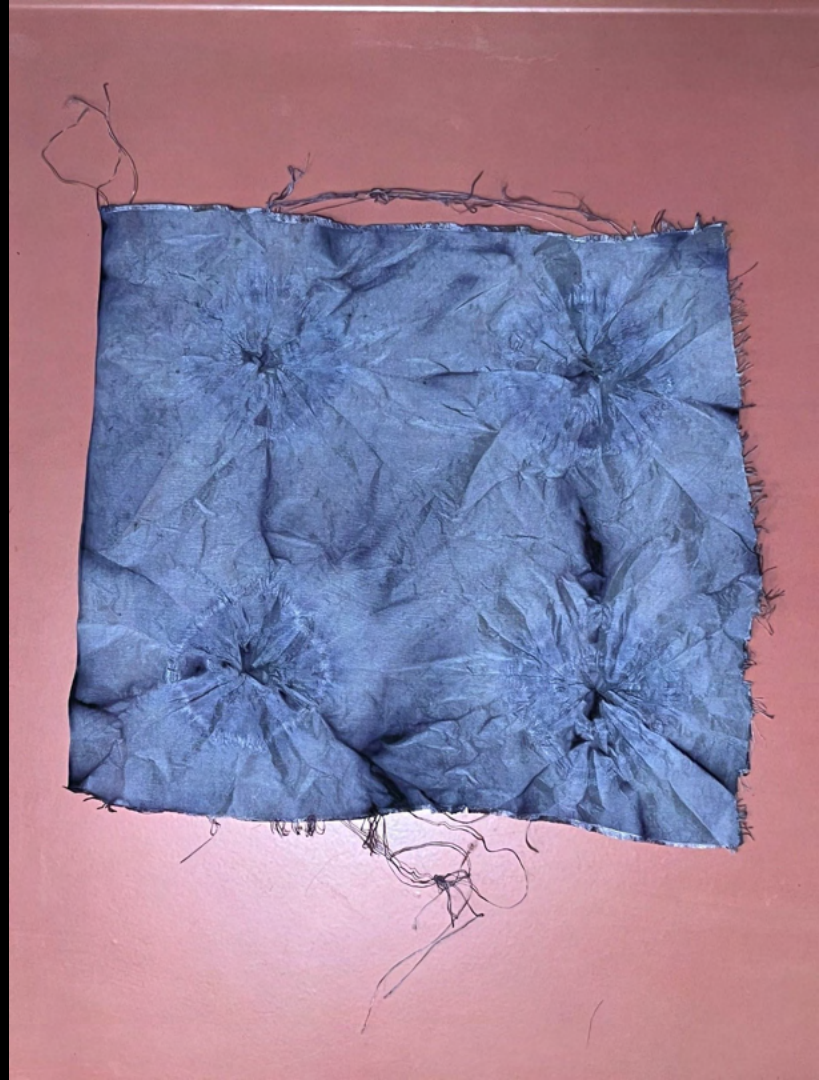
Material: silk
Dye: cochineal
Mordant: 2 tbsp
Patterning Technique: tie resist
Image: front of fabric



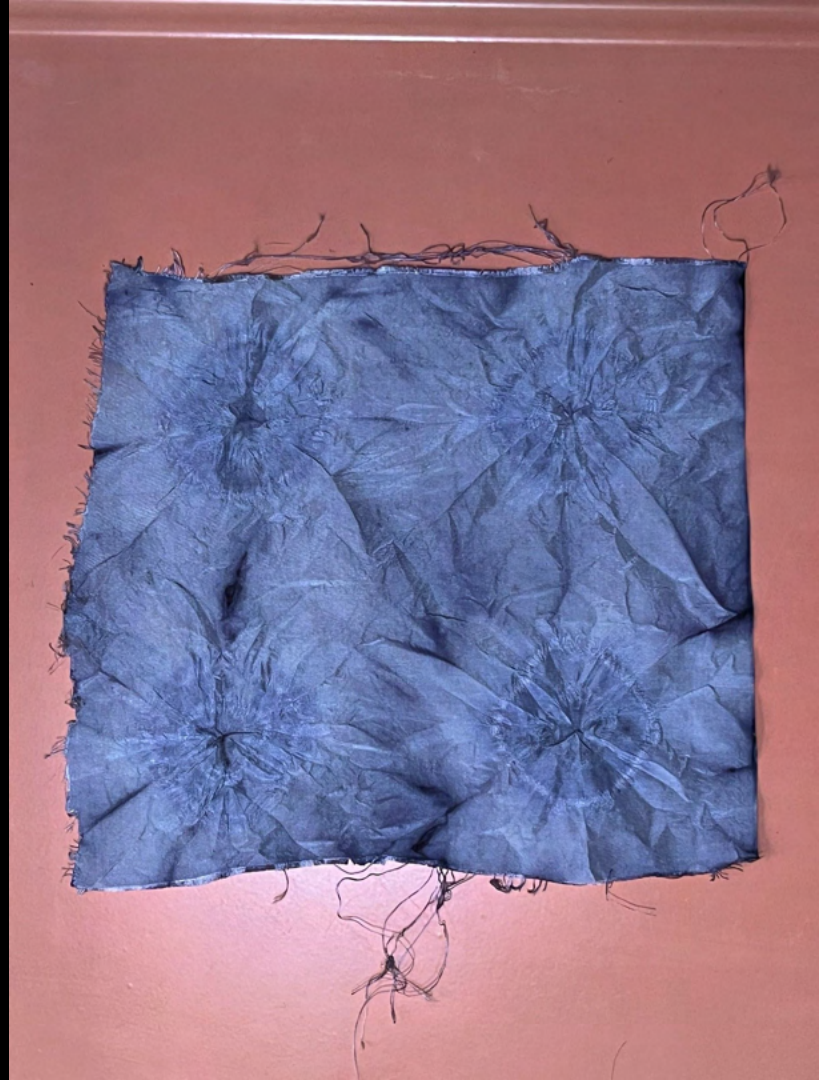
Material: silk
Dye: cochineal
Mordant: 2 tbsp
Patterning Technique: tie resist
Image: back of fabric



Material: silk
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: tie resist
Image: front of fabric



Material: silk
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: tie resist
Image: back of fabric



Material: cotton
Dye: oak bark over previously dyed cotton
Mordant: 4 tbsp
Patterning Technique: sew technique (in swirl)
Image: front of cloth

Material: cotton
Dye: oak bark over previously dyed cotton
Mordant: 4 tbsp
Patterning Technique: sew technique (in swirl)

Image: back of cloth

Material: linen
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: sew resist
Image: external side of folded fabric

Material: linen
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: sew resist
Image: internal side of folded fabric

Material: silk
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique:sew

Material: silk
Dye: cochineal
Mordant: 4 tbs
Patterning Technique: compression resist

Material: cotton
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: compression resist
Image: side one

Material: cotton
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: compression resist
Image: side two

Material: linen
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: compression resist
Image: both sides of the fabric compared to the original material

Final Results

From these series of experiments it is clear that the tie resist technique was the most successful across all pigments and fabrics. Our patterns emerged on cotton fabric when the sew technique was used, but it wasn't as clear on other fabrics. Compression resist dyeing created surprising patterns with all three fabrics, either by dyeing the edges of the folds, where it is most exposed to the dye bath, or by completely dyeing the centers of the triangles, where it is least exposed between the cardboard. Block patterning stuck onto the cotton when egg yolks were used as the binder, but not with gum arabic. The final results of our wax resist method proved to be the most frustrating, as the dye resist method seemed to work up until the moment when most of the dye was removed when the water boiled. Clearly the thicker the fabric, the more difficult it is for the dye to penetrate, which either leads to detrimental or positive effects, depending on the technique used.

Our final impressions on different fabric swatches are found on the next series of slides, in the order of tie resist, sew resist, compression resist, wax resist, then block printing methods. Within each grouping cotton, linen, then silk, are displayed, along with an iteration wherein we increased the amount of mordant so more of the results could be seen. Within each section we display first the cochineal dye baths, then the oak bark baths.

A concluding thought is that, considering that the initial idea of this project began with folio 15r of Ms. Fr. 640 and its attempt to imitate damask cloth, the author-practitioner of Ms. Fr. 640 was not a dyer himself, and most likely only interacted with techniques more commonly found outside of Europe. He may have thought of different ways one could use these techniques to imitate higher-priced fabric, especially when implementing the sew resist technique and the compression resist technique. One theory, backed by this project, is that the "Damasked cloth" recipe was collected for its potential to imitate, but it was probably not carefully studied or conducted by the author-practitioner.

Table of figures:

	Cotton				Linen				Silk			
	Co		OB		Co		OB		Co		OB	
Tie Resist	1-2		10-11		3-6		12-13		7-9		14-15	
Sew Resist	16-17		NR		18-19		NR		20-23		NR	
Compression Resist	24		NR		25		NR		26		NR	
	B	C	B	C	B	C	B	C	B	C	B	C
Wax Resist	27											

	Cotton			
	Egg Yolk		Gum Arabic	
	Co	YO	Co	YO
Block printing	28-29			

Co – cochineal

OB – oak bark

NR – no results, dye was too washed out and faded to see any results.

B – beeswax

C – candle wax

YO – yellow ochre

Material: cotton
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: tie resist
Image: front of cloth
Figure 1

Material: cotton
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: tie resist
Image: back of cloth
Figure 2

Material: linen
Dye: cochineal
Mordant: 2 tbsp
Patterning Technique: tie resist
Image: front of cloth
Figure 3

Material: linen
Dye: cochineal
Mordant: 2 tbsp
Patterning Technique: tie resist
Image: back of cloth
Figure 4

Material: linen
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: tie resist
Image: front of cloth
Figure 5

Material: linen
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: tie resist
Image: back of cloth
Figure 6

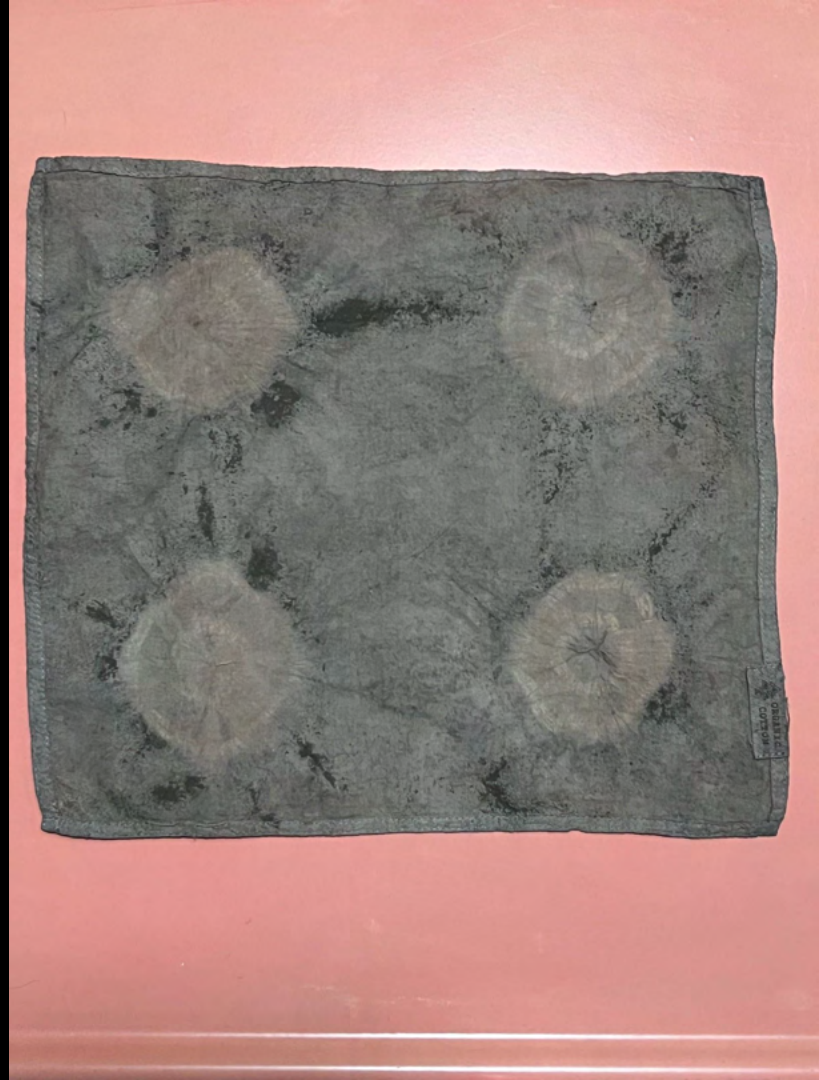
Material: silk
Dye: cochineal
Mordant: 2 tbsp
Patterning Technique: tie resist
Image: front of cloth
Figure 7

Material: silk
Dye: cochineal
Mordant: 2 tbsp
Patterning Technique: tie resist
Image: back of cloth
Figure 8

Material: silk
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: tie resist
Figure 9

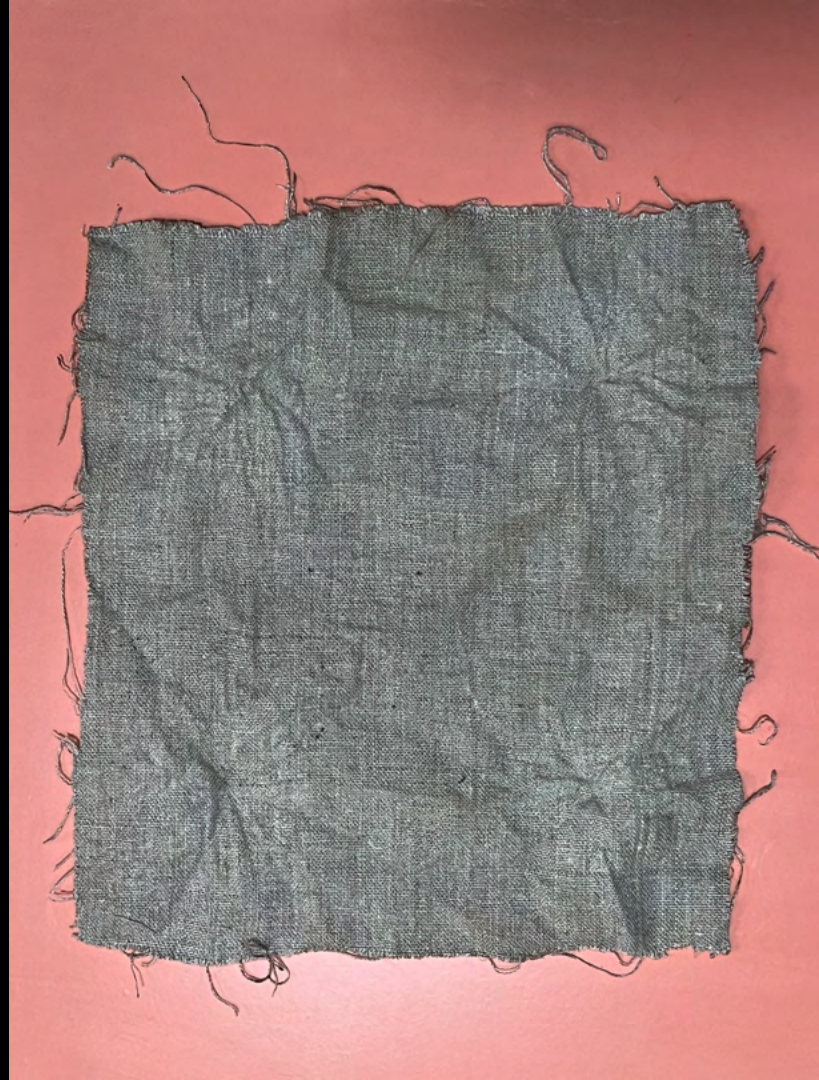
Material: cotton
Dye: oak bark
Mordant: 4 tbsp
Patterning Technique: tie resist
Figure 10

Material: cotton
Dye: oak bark
Mordant: 4 tbsp
Patterning Technique: tie resist
Figure 11



Material: linen
Dye: oak bark
Mordant: 4 tbsp
Patterning Technique: tie resist
Image: front of cloth
Figure 12

Material: linen
Dye: oak bark
Mordant: 4 tbsp
Patterning Technique: tie resist
Image: back of cloth
Figure 13



Material: silk
Dye: oak bark
Mordant: 4 tbsp
Patterning Technique tie resist
Image: front of cloth
Figure 14

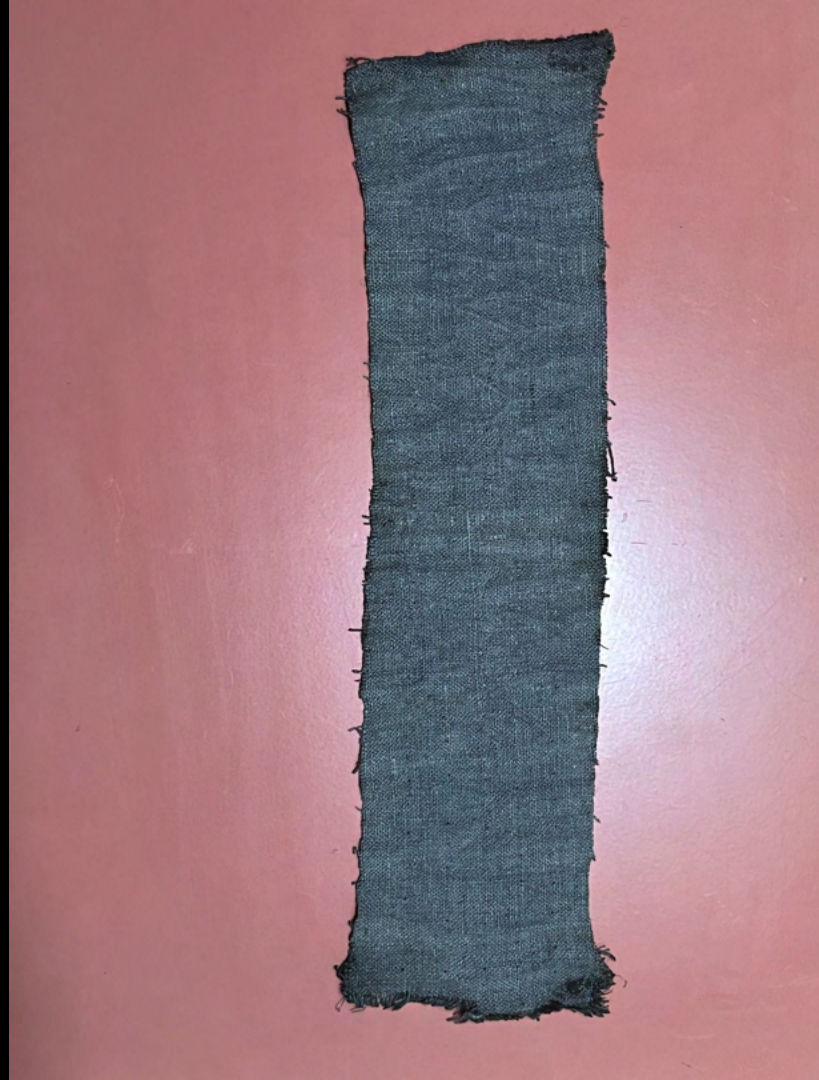
Material: silk
Dye: oak bark
Mordant: 4 tbsp
Patterning Technique tie resist
Image: back of cloth
Figure 15

Material: cotton
Dye: cochineal over previously dyed oak bark
Mordant: 4 tbsp
Patterning Technique: sew resist (swirl)
Image: external side of folded fabric
Figure 16

Material: cotton
Dye: cochineal over previously dyed oak bark
Mordant: 4 tbsp
Patterning Technique: sew resist (swirl)
Image: internal side of folded fabric
Figure 17

Material: linen
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: sew resist (straight stitch)
Image: external side of folded fabric
Figure 18

Material: linen
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: sew resist (straight stitch)
Image: internal side of folded fabric
Figure 19



Material: silk
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: tie resist (straight stitch)
Image: external side of folded fabric
Figure 20

Material: silk
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: tie resist (straight stitch)
Image: internal side of folded fabric
Figure 21

Material: silk
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: tie resist (swirl)
Image: external side of folded fabric
Figure 22

Material: silk
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: tie resist (swirl)
Image: internal side of folded fabric
Figure 23

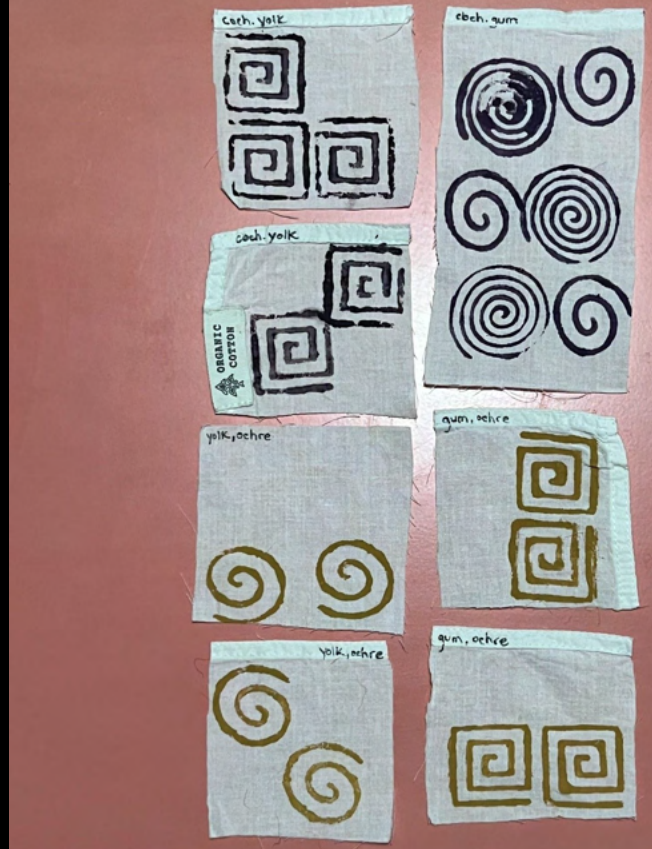
Material: cotton
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: compression resist
Figure 24

Material: linen
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: compression resist
Figure 25

Material: silk
Dye: cochineal
Mordant: 4 tbsp
Patterning Technique: compression resist
Figure 26

Material: linen, cotton, silk (top to bottom)
Dye: oak bark (top), cochineal (bottom)
Mordant: 2 tbsp
Patterning Technique: wax resist (candle wax left, beeswax right)
Figure 27

Material: cotton
Pigment: cochineal and yellow ochre
Binder: egg yolk (left) and gum arabic (right)
Patterning Technique: block print
Image: before washing off dye
Figure 28



Material: cotton
Pigment: cochineal and yellow ochre
Binder: egg yolk (left) and gum arabic (right)
Patterning Technique: block print
Image: after washing off dye
Figure 29

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