



Hunt Institute for Botanical Documentation
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About the Institute

The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

DOCUMENTING HERBARIUM SPECIMENS OF MANIHOT ESCULENTA

Directions for Collecting for Herbarium Specimens

Fill out the label (sample attached) as nearly completely as possible.

1. LOCALITY. give the country, the state, and the immediate locale. Add information about the nature of the soils in the vicinity.
2. COMMON NAME. If more than one common name is known for a particular variety of mandioca, put down those that are known.
3. STATION NUMBER. If the plant is being grown at an experiment station give the local station's number. Add the age of the plant.
4. ORIGIN. If the origin of the plant (that is, from what particular part of the country it was procured) is known, add this.
5. STEM:
 - a. Color External. I have used the following designations for other collections that may be adequate in describing the external color of the mature stem. Silver (gray); brown; red-brown; yellow; or orange. These colors will encompass most of the variations in external stem color.
 - b. Color Internal. The color of the woody portion of the internal part of the stem may be white or some shade of yellow, or perhaps a whitish green. Record this color.
6. BRANCHING. This is a very important attribute of the plant to be known and is difficult to include in herbarium specimens. In order to determine the branching pattern, perhaps it is well to make a scaled drawing which indicates the point at which the plant branches and the number of branches at each point. Put a scale to indicate the height of the plant along side the branching pattern. It is very useful to have a photograph of the plant if this can be arranged.
7. LEAF:
 - a. Color of Young Foliage. This is an indication of the color of the young foliage at the apex of any stem and may be recorded as reddish, reddish blue, bluish, or green.
 - b. Petiole Color. Record the colors of the upper portion of the petiole of a mature vegetative leaf at about a

center point between the insertion of the leaf on the stem and the insertion of the leaf blade.

8. ROOT. An important feature of the plant for purposes of taxonomy is to make a note on the -
 - a. Surface Condition of the root which may be recorded as follows: If the external layer of the root is dark brown it will most frequently have a very rough epidermis. If the surface of the root is a light tan or grayish color, most frequently this root's surface will be smooth. Therefore, surface condition of the root can be recorded as either rough or smooth.
 - b. External Color of the root should be recorded as light brown, dark brown, tan, or any other appropriately designated color.
 - c. Color of Subepidermis. Immediately below the epidermal layer, which can be easily peeled off the mature root, one may note the color of the subepidermal layer which may be either white or pink, or in some rare cases, light yellow or tan. One should add, as well,
 - d. The Color of the Flesh of the Root, most frequently white, but sometimes yellowish.
9. REMARKS. Include any specific qualities of the individual plant: (bitter or sweet), age to maturity, etc.
10. RECORD THE NAME OF THE COLLECTOR OF THE PLANT. If he has his own collecting numbers be sure to record them. Be certain that the date of the collection is given.

Portions of the Plant to be Included in the Herbarium Specimens

We have standardized the parts of the plant to be included in the herbarium specimen. First, the collector should examine the variability of a particular variety as it grows in the field and try to select from the set of plants representing that variety, one plant which typifies or seems to be representative of all the plants of that particular variety. Such an examination should include the colors to see whether or not the leaf and stem colors are fairly standard. Look at the branching patterns of the variety and discover one plant that seems to represent most of the branching patterns for that particular variety. After making a selection of one plant one should also check the mature vegetative leaves on the plant and count the number of lobes. Usually, the mature vegetative leaves will have a fairly standard number of lobes. The collector should examine several plants and count the lobes on the mature vegetative leaves and discover one leaf which represents the average

number of lobes for that particular variety. This leaf that he selects should be in as near perfect condition as possible.

After having made a survey the individual specimens should be taken up, roots and all, and photographed, or if a camera is not available, then, as suggested above, the branching pattern of the plant should be made into a simple diagrammatic sketch. After taking up the plant the specimens to be taken should include the following:

1. A mature leaf should be cut from the plant. Cut the stem with the leaf so that there is a portion of the stem attached to the mature vegetative leaf.
2. A portion of the apex of a vegetative shoot. That is, about a fifteen or twenty centimeter sample taken at the apex of one vegetative branch. If the variety also has flowers and/or fruit on it, then the specimen should include samples of these with their colors given.
3. A thirty centimeter length of the mature stem of the variety. This stem may be cut in half lengthwise in order to facilitate drying.
4. One mature section of the root. Make a longitudinal section, approximately one centimeter thick through the median portion of the length of the root. This section of the root may be attached to the stem sections in order to prevent the root section from breaking. These may be immersed in a weak solution of formaldehyde, about a five or ten per cent solution will be satisfactory to kill the stem and root tissues and prevent fungus attack.

The leaf and flower materials should be dried between newspapers in a standard manner of herbarium specimen preparation. The stem and root sections may be dried in a hot air oven. Each variety should have a sample made in the same manner.

The collector's number, the label and any sketches of the branching pattern must be kept with the specimens AT ALL TIMES.

Collection No. _____ Collector _____

Locality: Country _____ Province or State _____

Precise Locality _____

Soil description _____

Common Name _____ Date Collected _____ Age of cultivar _____

Root Characters:

1. Surface condition (Rough or Smooth) _____
2. External color _____
3. Subepidermis color _____
4. Cortex (flesh) color _____
5. Special information _____
(time of maturation, use, HCN content, starch qualities, etc.)

For color representation use some standard chart of colors, such as Nickerson Color Fan, Am. Hort. Council. Munsell hues, or other standardized color scheme.

Stem Characters:

1. External color _____
2. Internal stem color _____
3. Port (erect or inclined) _____
4. Distance from one node to next above _____
(average of several measures in cm.)

Leaf Characters:

1. Stipules (shape, size, caducous or lasting) _____
2. Leaf bases (enlarged, smooth, etc.) _____
3. Petiole color (the color on the upper surface
mid-way from base to apex) _____
4. Color of young foliage at stem apex _____

Pistillate Flower

1. Color of stigma _____
2. Color of disc at base of ovary _____
3. Color of tepals _____

Staminate Flower

1. Color of tepals _____
2. Number of stamens _____

Fruit

1. Winged or wingless _____
2. Color of wings _____

DATA COLLECTION FOR SYSTEMATIC STUDIES OF MANIHOT ESCULENTA

Collection No. _____ Collector _____

Locality: Country _____ Province or State _____

Precise Locality _____

Soil description _____

Common Name _____ Date Collected _____ Age of cultivar _____

Root Characters:

1. Surface condition _____
2. External color _____
3. Subepidermis color _____
4. Cortex (flesh) color _____
5. Special information _____
(time of maturation, use, HCN content, starch qualities, etc.)

For color representation use some standard chart of colors, such as Nickerson Color Fan, Am. Hort. Council. Munsell hues, or other standardized color scheme.

Stem Characters:

1. External color _____
2. Internal stem color _____
3. Port (erect or inclined) _____
4. Distance from one node to next above _____
(average of several measures in cm.)

Leaf Characters:

1. Stipules (shape, size, caducous or lasting) _____
2. Leaf bases (enlarged, smooth, etc.) _____
3. Petiole color (the color on the upper surface mid-way from base to apex) _____
4. Color of young foliage at stem apex _____

Pistillate Flower

1. Color of stigma _____
2. Color of disc at base of ovary _____
3. Color of tepals _____

Staminate Flower

1. Color of tepals _____
2. Number of stamens _____

Fruit

1. Winged or wingless _____

2. Color of wings _____

DOCUMENTING HERBARIUM SPECIMENS OF KANIHOT ESCULENTA

Directions for Collecting for Herbarium Specimens

Fill out the label (sample attached) as nearly completely as possible.

1. LOCALITY. Give the country, the state, and the immediate locale. Add information about the nature of the soils in the vicinity.
2. COMMON NAME. If more than one common name is known for a particular variety of manihot, put down those that are known.
3. STATION NUMBER. If the plant is being grown at an experiment station give the local station's number. Add the age of the plant.
4. ORIGIN. If the origin of the plant (that is, from what particular part of the country it was procured) is known, add this.
5. STEM:
 - a. Color External. I have used the following designations for other collections that may be adequate in describing the external color of the mature stem. Silver (gray); brown; red-brown; yellow; or orange. These colors will encompass most of the variations in external stem color.
 - b. Color Internal. The color of the woody portion of the internal part of the stem may be white or some shade of yellow, or perhaps a whitish green. Record this color.
6. BRANCHING. This is a very important attribute of the plant to be known and is difficult to include in herbarium specimens. In order to determine the branching pattern, perhaps it is well to make a scaled drawing which indicates the point at which the plant branches and the number of branches at each point. Put a scale to indicate the height of the plant along side the branching pattern. It is very useful to have a photograph of the plant if this can be arranged.
7. LEAF:
 - a. Color of Young Foliage. This is an indication of the color of the young foliage at the apex of any stem and may be recorded as reddish, reddish blue, bluish, or green.
 - b. Petiole Color. Record the colors of the upper portion

of the petiole of a mature vegetative leaf at about a center point between the insertion of the leaf on the stem and the insertion of the leaf blade.

8. **ROOT.** An important feature of the plant for purposes of taxonomy is to make a note on the -
 - a. **Surface Condition** of the root which may be recorded as follows: If the external layer of the root is dark brown it will most frequently have a very rough epidermis. If the surface of the root is a light tan or grayish color, most frequently this root's surface will be smooth. Therefore, surface condition of the root can be recorded as either rough or smooth.
 - b. **External Color** of the root should be recorded as light brown, dark brown, tan, or any other appropriately designated color.
 - c. **Color of Subepidermis.** Immediately below the epidermal layer, which can be easily peeled off the mature root, one may note the color of the subepidermal layer which may be either white or pink, or in some rare cases, light yellow or tan. One should add, as well,
 - d. **The Color of the Flesh of the Root**, most frequently white, but sometimes yellowish.
9. **REMARKS.** Include any specific qualities of the individual plant: (bitter or sweet), age to maturity, etc.
10. **RECORD THE NAME OF THE COLLECTOR OF THE PLANT.** If he has his own collecting numbers be sure to record them. Be certain that the date of the collection is given.

Portions of the Plant to be Included in the Herbarium Specimens

We have standardized the parts of the plant to be included in the herbarium specimen. First, the collector should examine the variability of a particular variety as it grows in the field and try to select from the set of plants representing that variety, one plant which typifies or seems to be representative of all the plants of that particular variety. Such an examination should include the colors to see whether or not the leaf and stem colors are fairly standard. Look at the branching patterns of the variety and discover one plant that seems to represent most of the branching patterns for that particular variety. After making a selection of one plant one should also check the mature vegetative leaves on the plant and count the number of lobes. Usually, the mature vegetative leaves

will have a fairly standard number of lobes. The collector should examine several plants and count the lobes on the mature vegetative leaves and discover one leaf which represents the average number of lobes for that particular variety. This leaf that he selects should be in as near perfect condition as possible.

After having made a survey the individual specimens should be taken up, roots and all, and photographed, or if a camera is not available, then, as suggested above, the branching pattern of the plant should be made into a simple diagrammatic sketch. After taking up the plant the specimens to be taken should include the following:

1. A mature leaf should be cut from the plant. Cut the stem with the leaf so that there is a portion of the stem attached to the mature vegetative leaf.
2. A portion of the apex of a vegetative shoot. That is, about a fifteen or twenty centimeter sample taken at the apex of one vegetative branch. If the variety also has flowers and/or fruit on it, then the specimens should include samples of these with their colors given.
3. A thirty centimeter length of the mature stem of the variety. This stem may be cut in half lengthwise in order to facilitate drying.
4. One mature section of the root. Make a longitudinal section, approximately one centimeter thick through the median portion of the length of the root. This section of the root may be attached to the stem sections in order to prevent the root section from breaking. These may be immersed in a weak solution of formaldehyde, about a five or ten per cent solution will be satisfactory to kill the stem and root tissues and prevent fungus attack.

The leaf and flower materials should be dried between newspapers in a standard manner of herbarium specimen preparation. The stem and root sections may be dried in a hot air oven. Each variety should have a sample made in the same manner.

The collector's number, the label and any sketches of the branching pattern must be kept with the specimens AT ALL TIMES.

Documenting specimens
x V
~~Documente~~ Herbarium of Manihot esculenta (all caps.)

Directions for collecting for herbarium specimens. → (center of paper)

~~Fill~~ Fill out the label ^(sample attached) as nearly completely as possible.

1. LOCALITY ^{SG} - give the country, the state, and the immediate locale. Add information about the nature of the soils in the vicinity.
2. COMMON NAME ^{IF} - If more than one common name is known for a particular variety of manihot, put down those that are known.
3. STATION NUMBER - If the plant is being grown at an experiment station give the local station's number. Add the age of the plant.
4. ORIGIN - if the origin of the plant (that is, from what particular part of the country it ~~is~~ was procured) is known add this.
5. STEM:-
 - a. Color External - I have used the following designations for other c collections that may be adequate in describing the external color of the mature stem. Silver (gray); brown; red-brown; yellow; or orange. These colors will encompass most of the variation in external stem color.
 - b. Color Internal - The color of the woody portion of the internal part of the stem may be white or some shade of yellow, or perhaps a whitish green. Record this color.
6. BRANCHING - This is a very important attribute of the plant to be known and is difficult to include in herbarium specimens. In order to determine the branching pattern perhaps it is well to make a scaled drawing which indicates the point at which the plant branches and the number of branches at each point. But a scale to indicate the height of the plant along side the branching pattern. It is very useful to have a photograph of the plant if this can be arranged.
(1 = none; 2 = at base; 3 = $\frac{1}{4}$; 4 = $\frac{1}{2}$; 5 = $\frac{3}{4}$; 6 = near top)

7. --BED-COLOR

7. LEAF:

- a. ~~BED~~ COLOR ^{of young foliage} - this is an indication of the color of the young foliage at the apex of any stem and may be recorded as reddish, reddish blue, bluish, or green. ~~The m~~
- b. ~~PETIOLE~~ COLOR ^{of a mature vegetative leaf} - ~~the~~ record the colors of the upper portion of the petiole at about a center point between the insertion of the leaf on the stem and the insertion of the leaf blade. ~~ignore the design~~

8. ROOT: an important feature of the plant for purposes of taxonomy is to make a note on ~~the~~ the
a. SURFACE CONDITION of the root which may be recorded as

dark
follows: If the external layer of the root is brown it will most frequently have a very rough epidermis. ~~If~~ on the other hand, the surface of the root is a light tan or grayish color ~~it~~ most frequently the root's surface will be smooth. Therefore, surface condition of the root can be recorded as either rough or smooth.

External Color
b. EXTERNAL COLOR of the root should be recorded as light brown, dark brown, tan, or any other appropriately designated color.

Color of Subepidermis
c. COLOR OF SUBEPIDERMIS. Immediately below the epidermal layer, which can be easily peeled off of the mature root, one may note the color of the subepidermis--a subepidermal layer which may be either white or pink or, in some rare cases, light yellow or tan. One should add, as well, ~~the color~~ ^{of} the color of the flesh of the root, ~~most~~ ^{most} frequently white, but sometimes yellowish.

9. REMARKS

7. Include any specific qualities of the individual plant: *(bitter, or sweet)*
10. ~~Record~~ ^{Record} the name of the collector of the plant. If he has ~~a~~ ^{his own} specific number, be sure to record ~~that~~. Be certain that the date of the collection is given. *them* ^{collecting numbers}

Not exp's

Portions-of-the-p-

PORTIONS OF THE PLANT TO BE INCLUDED IN THE HERBARIUM SPECIMEN

We have standardized the parts of the plant to be included in the herbarium specimen. First, the collector should examine the variability of a particular variety as it grows in the field and try to select from the set of plants representing that variety one plant which typifies or seems to be representative of ~~the~~ ^{the} whole all the plants of that particular variety. Such an examination should include the colors to see whether or not the leaf colors ~~are~~ ^{are} fairly standard and the stem colors are fairly standard. You should also look at the branching patterns of the variety and discover one plant that seems to represent most of the branching patterns for that particular variety. After making ~~the~~ ^{the} selection of one plant, also one should check the mature vegetative leaves on the plant and count the number of lobes. Usually, the ~~the~~ ^{the} mature vegetative leaves will have a fairly standard number of lobes ~~leaves~~. The collector should examine several plants and count the lobes on ~~the~~ ^{the} mature vegetative leaves and discover one leaf which represents the average number of lobes for that particular variety. This leaf that he selects should be in as near perfect condition as possible. ~~After~~ ^{After} having made a survey

After having made a survey the individual specimens should be taken up roots and all and photographed or, if the camera is not available then, as ~~s~~ ^s suggested above, the branching pattern of the plant should be made into a simple diagramatic sketch. After

taking up the plant the ~~the~~ specimens to be taken should include the following:

1. A mature leaf should be cut from the plant. Cut the stem with the leaf so that there is a portion of the stem attached to the leaf mature vegetative leaf.
2. A portion of the apex of a vegetative shoot. That is, about a fifteen or twenty centimeter sample taken at the apex of one vegetative branch. If the variety also has flowers and/or fruit on it, then the specimen should include samples of these with their colors given.
3. A thirty centimeter length of the mature stem of the variety. This stem may be cut in half lengthwise in order to facilitate drying.

4. One mature section of the root. Make a longitudinal section, approximately one centimeter thick through the median portion of the length of the root. This section of the root may be attached to the stem sections in order to prevent the root section from breaking. These may be ~~soaked~~ immersed in a weak solution of formaldehyde, about a five or ten per cent solution will be satisfactory to kill the stem and root tissues and prevent fungus attack. These should all be fairly ~~dry~~ dried. The leaf and flower materials be dried between newspapers in a standard manner of herbarium collecting. The stem and ~~see~~ root sections may be dried in a hot air oven. Each variety should have a sample made in the same manner.

immersed

→ formaldehyde

should
specimens prepared

The collector's
number, the label
and any
sketches of

Circumvent any problems that might occur when dealing with the introduction of these things.

the branching pattern must be kept with the specimens

AT ALL TIMES

No. Collector: D. J. Rogers, _____ Date

Precise Locality: Altitude Longitude Latitude

Country State

Nomen Vulgare

ECOLOGY

- 1) Vegetational pattern: A) predominant in the local vegetation B) sparse
C) only this solitary plant in sight
D) others (mention)

- 2) Local vegetation: A) savannah B) prairie C) Tropical rain forest
D) needle forest E) desert
F) Other (mention)

- 3) Local flora: (Names of other plants in the vicinity)

- 4) Soil (physical): A) Lateritic B) Sand C) Clay D) Loam
E) Other (mention)

- 5) Soil (chemical): A) Remarks about the appearance of the soil (alkaline, water
stagnation, etc.)

B) Remarks about the nutritional status of soil (rich, medium,
poor, etc.)

- 6) Any other ecological remarks:

PLANT HABIT

- 1) Height 2) Spread 3) Habit
4) Branching pattern
5) Any other remarks:

YOUNG SHOOT 1) Pigmentation

- STEM 2) Pigmentation of young stem 3) Pig. of old stem

LEAVES : Pigmentation of

- 1) petiole 2) stipules 3) veins on upperside
4) veins on lower side

INFLORESCENCE: Pigmentation of

- 1) tepal, outside 2) tepal, inside 3) buds
4) bracteole 5) bractlet 6) disc
7) stigma 8) ovary
9) Open flower - reflexed, not reflexed 10) Time of anthesis of female flowers
11) Time of anthesis of male flowers
12) Pollen - abundant, sparse, nil 13) Natural fruit set - prolific, sparse, nil
14) Mode of pollination
15) Any other remarks

FRUIT

- 1) Shape 2) Apex (prominently pointed, slightly pointed, rounded)
3) Wings (prominent, not prominent, smooth) 4) Surface (rough, smooth)
5) Maturity 6) Pigmentation of fruit
7) Any other remarks

ROOTS

- | | |
|---|--------------------------------|
| 1) Lateral spread of feeder root system | 2) Depth of feeder root system |
| 3) Roots tuberous or not | 4) Number of tuberous roots |
| 5) Shape of tuberous roots | 6) Color of epidermis |
| 7) Color of subepidermis | 8) Color of flesh |
| 9) Consistency of flesh | |
| 10) Remarks | |

PRUSSIC ACID: Remarks

USES: Remarks

SYMPTOMS OF DISEASES OR PEST ATTACK: Remarks

DROUGHT RESISTANCE: Remarks

PROPAGATION: (by tuberous roots, stem cuttings, seeds, etc.)