Minimum List of Descriptors for *Musa*

Developed by the MusaNet Taxonomy Advisory Group – version Sept 2019

INTRODUCTION

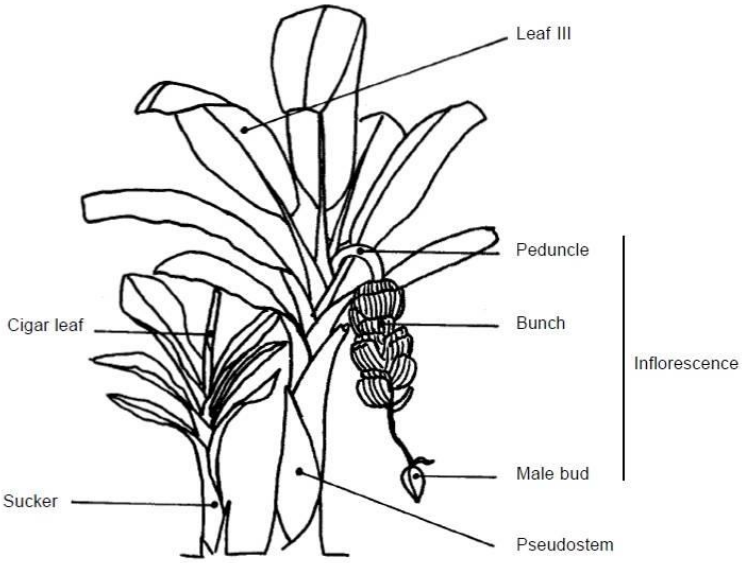
These guidelines, recently revised in 2019, aim to establish a standardised procedure for the routine morphological characterization of banana plants. Photographs are provided to help score the minimum descriptors. For any question, remark and feedback on these guidelines, please contact Rachel Chase (r.chase@cgiar.org) or Nicolas Roux (n.roux@cgiar.org).

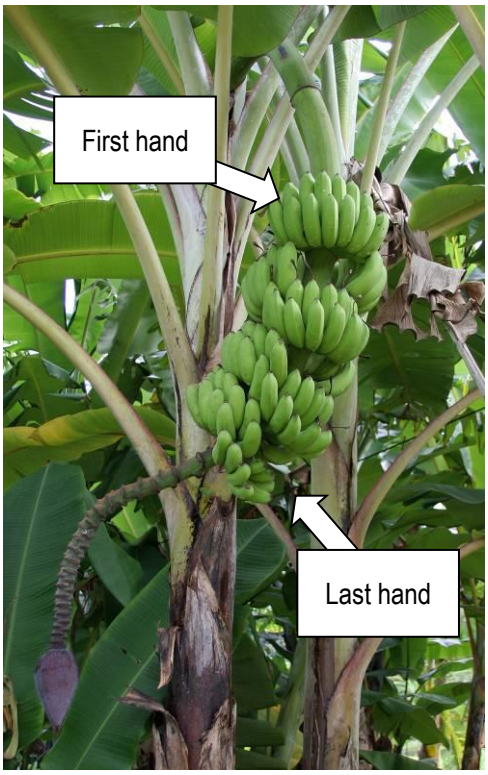
THE APPROPRIATE DEVELOPMENT STAGE FOR OBSERVATION

The best time to take photos and document the descriptors is when the fruit are green-ripe or yellowing ("harvest time"), and the rachis is at least 45 cm long (15 inches). All descriptors should be scored at harvest **except** for descriptors 6.3.1, 6.3.3, 6.3.4a, 6.3.4b, 6.3.6, 6.3.7 that should be recorded at flowering time (emergence of the inflorescence) to avoid the desiccation of the petiole margin that often occurs at harvest time.

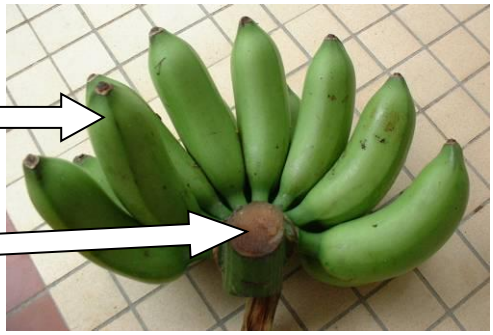
For all **colour descriptors**, colour should be determined with the appropriate colour chart and out of direct sunlight. The best time to observe colour descriptors is in the morning when the light is clearer than in the afternoon. Score the closest colour to the choices given (e.g. if dark green is not given as a choice, choose green).
For all **flower descriptors** (6.6.2 - 6.6.13) the material should be fresh as it oxidizes and changes colour rather quickly.
For the **fruit descriptors** (6.7.3 - 6.7.11) observation must be done on several fruits in order to reflect the dominant case.

THE BANANA PLANT





The individual **fruits** also called "fingers" in the **bunch** (photo top-right) are arranged in clusters called "**hands**" along the **rachis** (photo bottom-right)



VEGETATIVE DESCRIPTORS (15)

6.2.1 Pseudostem height (m) (Recorded from the base of the pseudostem to the emerging point of the peduncle)

1. ≤2
2. 2.1 to 2.9
3. ≥3

6.2.5 Main underlying colour of the pseudostem

Detach the **outermost sheath** from the pseudostem (the sheath should not be too dry). Record the <u>overall</u> impression of colour of the exposed surface of the underlying pseudostem. Note that this 'main colour' should cover more than 75% of the underlying pseudostem surface. Use colour chart A and observe out of direct sunlight.

1. Watery green
2. Light green
3. Green
4. Cream
5. Pink-purple
6. Red-purple
7. Purple
8. Other

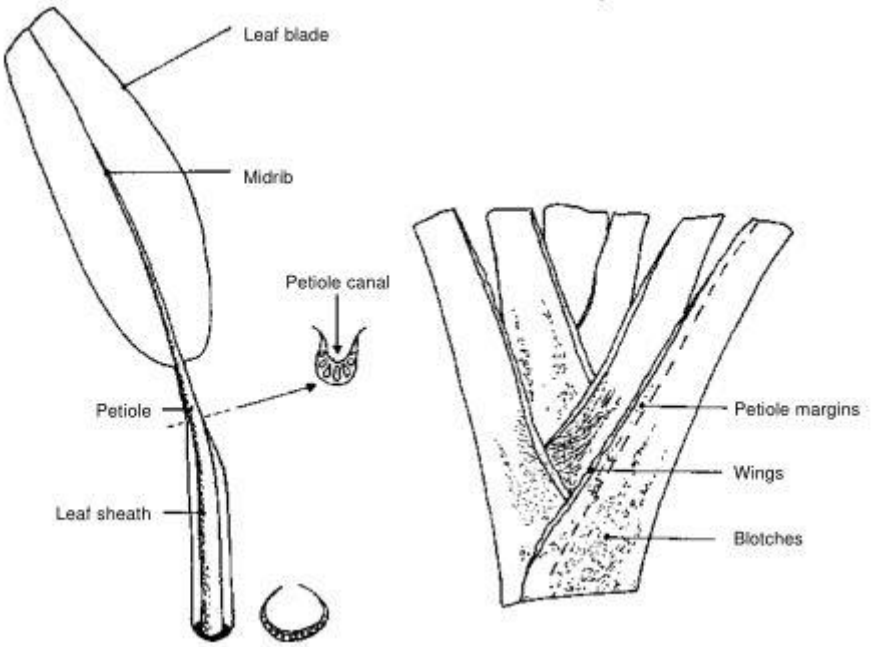


Figure 1. Petiole/midrib/leaf (from Champion 1963 (left), De Langhe 1961 (right). This diagram is used to help with descriptors 6.3.1 through 6.3.7.

6.3.1 Blotches at the petiole base

Record the relative surface area coverage by blotches. Look at several plants if possible to get an overall idea. Observe at flowering time.

1. No pigmentation
2. Sparse blotching (<20%)
3 Moderate blotching (20%-50%)
4. Extensive pigmentation (>50%)

1. 2. 3. 4.

6.3.2 Blotches colour (petiole base) – scored on the upper leaf sheath

1. Orange-brown (like in Pisang Mas)
2. Brown
3. Black-purple
4. Other

6.3.3 Petiole canal of the third leaf

The third leaf (Leaf III) is counted from the last leaf produced before bunch emergence. Cut the petiole halfway between the pseudostem and the leaf blade and examine the cross section. Observe at flowering time.

1. Margins spreading
2. Margins erect
3. Margins curved inward
4. Margins overlapping

1. 2. 3. 4.

For descriptors **6.3.4 to 6.3.8** observations on the margins and petiole wings should be made where the petiole and pseudostem meet at shooting.

6.3.4.1 Petiole margins winged

Margin is the part of the petiole that can be bent outwards/inwards. Observe at flowering time.

1. Winged (undulating or non-undulating)
2. Not winged


1.


2.

6.3.4.2 – Petiole margins clasping

Observation should be made at shooting on the neck, where the petiole and pseudostem meet. Margin is the part of the petiole that can be bent outwards/inwards. Observe at flowering time.

1. Clasping
2. Not clasping


1.


2.

6.3.6 Petiole margin colour

Use colour chart A and observe out of direct sunlight. Record the colour of the margin (general colour is below the rim). Observe at flowering time.

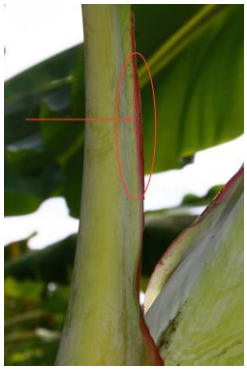
1. Green
2. Pink-purple to red
3. Purple to blue
4. Other

6.3.7 Edge of petiole margin (rim)

Observation should be made at shooting. Record on the last developed leaf at flowering stage.

1. No contrast between margin and petiole (without a colour line along)
2. Contrast between margin and petiole (with a contrasting colour line along)


1.


2.

6.3.22 Pigmentation of outer surface of cigar leaf

Use colour chart A. Observation should be made before shooting, on a developed sucker or on another plant of the same accession. Look at the visible face (future lower face) of the cigar leaf before it is unfurled and before the plant flowers.

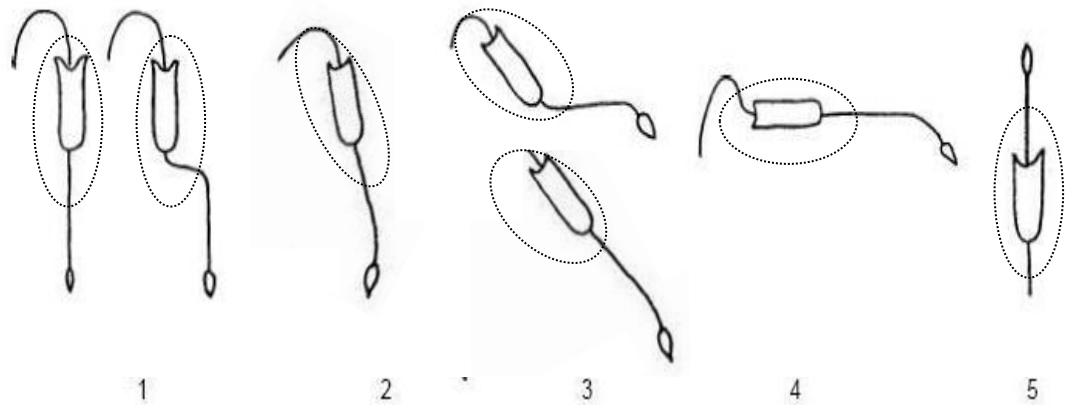
1. Green
2. Red-purple
3. Other (specify on answer sheet)

6.4.5 Peduncle hairiness

1. Hairless
2. Slightly hairy
3. Very hairy, short hairs (similar to velvet touch)
4. Very hairy, long hairs (>2mm)

6.4.6 Bunch position (Angle between the axis of the bunch and the vertical)

1. Hanging vertically
2. Slightly angled
3. Hanging at a 45° angle
4. Horizontal
5. Erect



6.4.7 Bunch shape

Score on fully developed plant with no environmental stress.

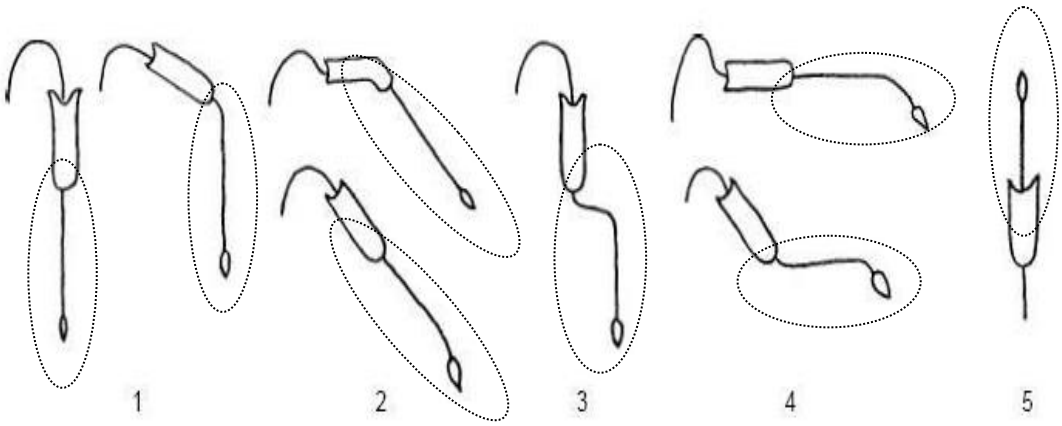
1. Cylindrical
2. Truncate (= cone shaped)
3. Asymmetrical
4. Spiral (all fruit are attached to a unique crown coiled around the stalk)
5. Other

1. 2. 3. 4.

6.4.12 Male rachis position

Observe only the part of the rachis between the last hand and the male bud.

1. Falling vertically
2. At an angle
3. With a curve
4. Horizontal or supra-horizontal
5. Erect



6.4.13 Male rachis appearance

1. Bare
2. Neutral flowers on one to few hands only near the bunch (rest of stalk is bare)
3. Male flowers/bracts above the male bud (rest of stalk is bare)
4. Neutral/male flowers and presence of withered bracts on the entire stalk
5. Neutral/male flowers on the whole stalk without persistent bracts (still firmly attached to the rachis)
6. Small bunch from neutral/hermaphrodite flowers just above the male bud
7. Other

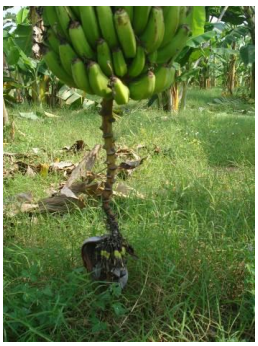

1.


2.


3.


4.


5.


6.

FLOWER DESCRIPTORS (11)

For the following descriptors, measure the values w, x, y.

"w" is the broadest width of the male bud. "x" is the length from the base of the male bud to the point of broadest width 'w'; "y" is the total length of the male bud. As the figure shows, these parameters express the profile of the bud. Do not measure the dimensions along the bud but rather on a projection/outline of the bud (e.g. trace the outline of the bud on paper).

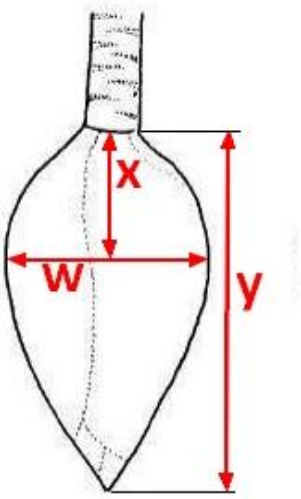


Figure 2. Male bud shape dimensions to be used in 6.4.15, 6.4.16, and 6.4.17

6.4.15 Male bud shape

Calculate the ratio w/y (see figure 2 above).
1. Skinny (w/y ≤ 0.45)
2. Medium (0.45 < w/y < 0.55)
3. Fat (w/y ≥ 0.55)

6.4.16 Male bud length (cm)

Measure the length (y) of male bud at harvest (see figure 2 above).
1. Short (y ≤ 20 cm)
2. Medium (20 cm < y < 30 cm)
3. Long (≥ 30 cm)

6.4.17 Male bud shoulder

Calculate the ratio x/y (see figure 2 above).
1. High shouldered (x/y ≤ 0.28)
2. Medium shouldered (0.28 < x/y < 0.30)
3. Low shouldered (x/y ≥ 0.30)

6.5.2 Bract apex shape

Refers to the first external unlifted bract. Flatten bracts to determine shape.

1. Pointed
2. Intermediate
3. Obtuse
4. Obtuse and split

1. 2. 3. 4.

6.5.3 Bract imbrication (Alignment of bracts at the apex of the male bud)

1. Convolute
2. Moderately imbricate
3. Highly imbricate

1. 2. 3.

6.5.12 Bract behaviour before falling

Refers to the last lifted bract. Best to record as bract has lifted up to the horizontal.

1. Revolute (rolling)
2. Not revolute (not rolling)


1.


2.

6.5.4 Colour of the bract external face

Refers to the first external unlifted bract. Remove any wax before scoring. Use colour chart A and observe out of direct sunlight.

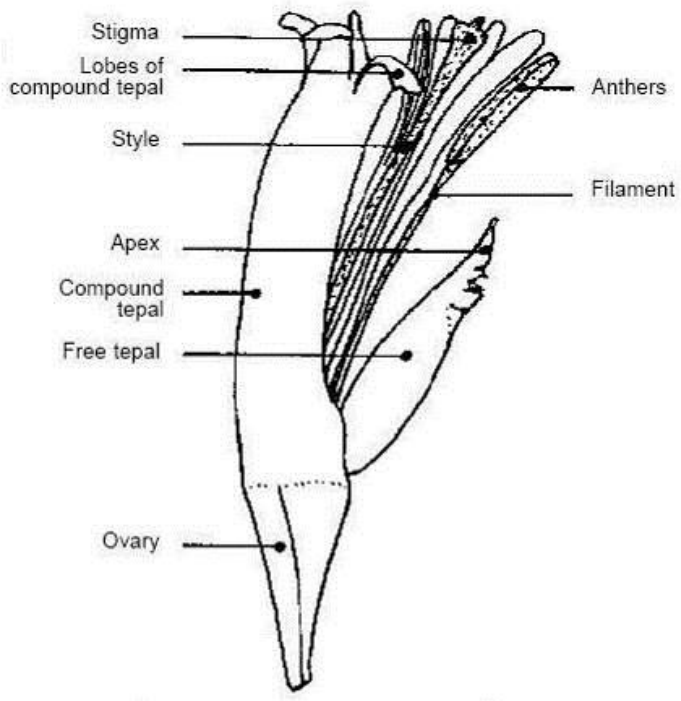
1. Yellow
2. Green
3. Red
4. Red-purple
5. Purple-brown
6. Purple
7. Blue
8. Pink-purple
9. Orange-red
10. Other

6.5.5 Colour of the bract internal face.

Refers to the first external unlifted bract. Do not consider basal part of bract. Use colour chart A and observe out of direct sunlight.

1. Whitish
2. Yellow or green
3. Orange-red
4. Red
5. Purple
6. Purple-brown
7. Pink-purple
8. Other

The following **flower descriptors** refer to the flowers at the axil of the first external unlifted bract. Fresh material must be used (make the observation as soon as you detach the bract/flowers from the rachis). For photos, place the object upon a very contrasting background and take the photo as close up as possible. The flower parts should be as visible as shown on the figure below.



6.6.2 Compound tepal main colour

Look at backside middle of tepal. Use colour chart B and observe out of direct sunlight.

1. White
2. Cream
3. Yellow
4. Orange
5. Pink / pink-purple
6. Other

6.6.4 Lobe colour (tip of the tepal) of compound tepal

Use colour chart B and observe out of direct sunlight.

1. Cream
2. Yellow
3. Orange
4. Green
5. Other

6.6.13 Anther colour

Observe on the face opposite to the dehiscence split of the anther. Use colour chart B and observe out of direct sunlight.

1. White
2. Cream
3. Yellow
4. Grey
5. Brown / rusty brown
6. Pink / pink-purple
7. Black (anthers aborted)
8. Other

FRUIT DESCRIPTORS (8)

7.10 Number of hands on the whole bunch

Exact value: ____

Tip: On a bunch with mostly hands of >10 fingers, a possible ultimate hand with 1-5 (rather smaller) fingers should not be counted.

6.7.2 Number of fruits on the mid-hand of the bunch

Count only fully developed fruit. If there is an even number of hands, there will be two middle hands. Count the middle hand that developed first.

1. ≤12
2. 13-16
3. ≥17

6.7.3 Fruit length (cm) at maturity

Measured as the internal arc of the fruit, without pedicel. Record on the inner fruit in the middle of the mid-hand of the bunch. If there is an even number of hands, there will be two middle hands. Count the middle hand that developed first. Record the exact value and range.

Exact value: ____

1. ≤15 cm
2. 16-20 cm
3. 21-25 cm
4. 26-30 cm
5. ≥31 cm

6.7.4 Fruit shape (longitudinal curvature)

Observe the inner fruit in the middle of the mid-hand of the bunch. In case of an asymmetric bunch, score the dominant fruit shape appearing in the bunch.

1. Straight
2. Slightly curved
3. Straight in the distal part
4. Curved (sharp curve)
5. Curved in slight 'S' shape (double curvature)
6. Other


1.


2.

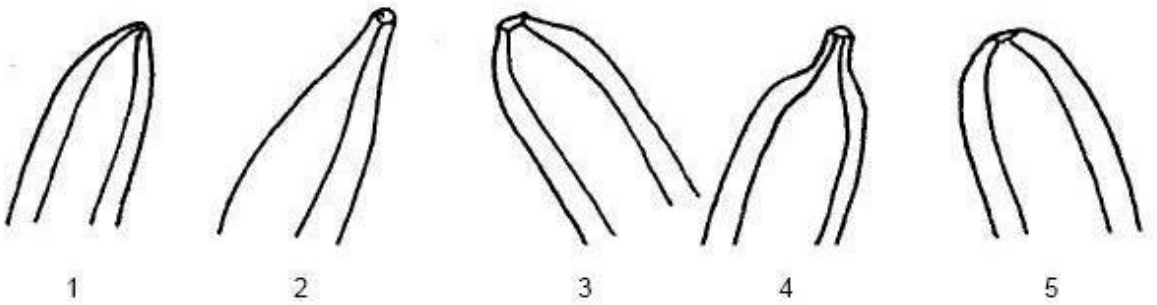

3.


4.


5.

6.7.6 Fruit apex

1. Pointed
2. Lengthily pointed (like plantain)
3. Blunt-tipped (plateau at tip)
4. Bottle-necked (wider under tip than number 2)
5. Rounded



6.7.7 Remains of flower relicts at fruit apex

Observe before cutting the bunch as relicts may fall off.

1. Without flower relicts
2. Few flower relicts (<20% of the fruits with relicts)
3. Persistent flower relicts (>20% of the fruits with relicts)
4. Only base of the style persists


1.


2.


3.


4.

6.7.8 Fruit pedicel length (mm).

Measure from the scar on the rachis until the beginning of the fruit. Record on the inner fruit in the middle of the mid-hand of the bunch. **Tip**: use string to measure or trace outline of fruit on paper. Record the exact value and range.

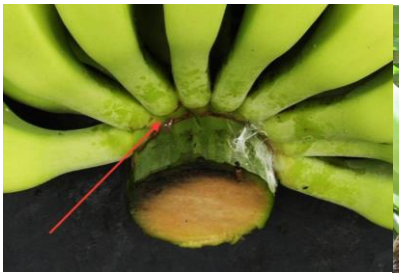
Exact value: ____

1. ≤10 mm
2. 11 to 20 mm
3. ≥21 mm

6.7.11 Fusion of pedicels

Before they join the rachis at the bract scar. Look up from bottom of bunch**.**

1. No visible sign of fusion
2. Partially fused (up to 50% of the length of the pedicel)
3. Totally fused (more than 50% of the length of the pedicel)



1.

2.

3.

Glossary of terms

Anther – Pollen-bearing portion of stamen.

Apex – Bottom tip (of male bract in this case).

Bract - a leaf-like structure, usually different in form from the foliage leaves, associated with an inflorescence or flower.

Bunch – the descriptive term for all the fruits along the rachis. The individual fruit (also called fingers) are arranged in hands.

Cigar leaf - rolled leaf emerging from the centre of the pseudostem.

Clasping - Partly surrounding the stem.

Convulate -– With one lamina enrolled in another lamina.

Distal – Away from the point of origin or attachment.

Edge –outside rim of the petiole

Hand – Arrangement of the fruit in a bunch, previously clusters of flowers.

Imbrication - Alignment of bracts at the apex of the male bud.

Male bud –The composite of male flowers and their bracts, in the form of a bud at the end of the growing male rachis.

Margin – area just below the edge of the petiole

Node - the place on a plant stem where a leaf is attached.

Rachis – the stem of the entire inflorescence from the first hand to the male bud.

Sheath – the part of the leaf clasping or enveloping the pseudostem.

Pedicel - the stem which supports one flower or fruit.

Peduncle - the stem that supports the inflorescence and attaches it to the pseudostem.

Petiole - the stem of a leaf.

Pseudostem - a false stem made of the rolled bases of leaves.

Tepal - a segment of the outer whorl in a flower that has no differentiation between petals and sepals.

Citation: Taxonomic Advisory Group (TAG) 2010. Minimum Descriptor List for *Musa.* Revised 2019. Bioversity International, Montpellier, France.