



E-ISSN: 2321-2187
P-ISSN: 2394-0514
IJHM 2015; 2 (5): 38-42
Received: 12-10-2014
Accepted: 12-11-2014

Okereke C. N
Department of Applied Biology,
Ebonyi State University
Abakaliki, Ebonyi State Nigeria.

Iroka F. C.
Department of Botany, Nnamdi
Azikiwe University, P. M. B
5025 Awka, Anambra State,
Nigeria

Chukwuma M.O
Nwafor Orizu College of
Education, Nsugbe, Anambra
State, Nigeria

Assessing the morphological and taxonomic characteristics of some members of convolvulaceae family

Okereke C.N, Iroka F.C, Chukwuma M.O

Abstract

The assessment of the morphological and taxonomic characteristics of some members of Convolvulaceae family was determined using standard method of analyses. The family is distributed throughout the world, having weed representations and the family is distinguishable by its plicate corolla, axile placentation with few ovules, bicollate vascular bundles and latex, symmetrical corolla, the floral formulae and superior gynoeceum. The result obtained showed that *Ipomoea batatas* presented in table 1 had plant III as the highest plant length of 150 cm, leaf length of 70.3 cm, leaf breadth of 32.2 cm and the flower length of 4.5 cm followed by breadth of by plant I which had the highest value of successive internodes and plant IV had the least value of plant length of 30 cm and leaf breath of 17.7 cm. *Ipomoea triloba* Presented in table 2 showed plant V to be the highest in plant length (186 cm), in successive internodes (14.82), in leaf length (17.72 cm) and leaf breadth (13.70 cm) whereas plant IV was the least in all the parameters. *Ipomoea involucrate* presented in table length (450 cm), leave breadth (8.40 cm), leaf length (15.50 cm) and successive internodes whereas plant V showed the least result in leaf breadth (3.01 cm) and plant IV showed least value of plant length (144 cm). *Evolvulus alsinoides* in table 4 showed plant I as the highest in plant length (45 cm), leaf breadth (9 cm), successive internodes (1.73 cm) and leaf breadth (1.48) whereas plant II showed the least result in plant length (28 cm), leaf length (1.70 cm), leaf breadth (0.94 cm) and flower length (1.34 cm). *Ipomoea vegans* presented in table 5 showed plant I to be highest in plant length (137 cm), successive internodes (3.60 cm) and leaf length (9.79) whereas plant IV showed the least value in plant length (61 cm), successive internodes (2.82 cm), leaf length (5.12 cm) and leaf breadth (2.26 cm). Generally, the members in Convolvulaceae family have morphological differences or species uniqueness which aids in easy identification of the members.

Keywords: Convolvulaceae, *Ipomoea*, Morphological, *Hewittia sublobata*, *Evolvulus alsinoides*, *Merremia aegyptia*

1. Introduction

Convolvulaceae is derived from a latin name *Convolvare*, meaning "To wind". It is commonly known as bindweed or morning glory family, they are a group of 50-60 genera and about 1600-1700 species [1]. More than one-third of the species are included in two major genera, *Ipomea* and *Convolvulus* [2]. Family Convolvulaceae are distributed throughout the world, but primarily tropical, with many genera endemic to individual continents [3]. Although the family is best known in temperate region for its weedy representatives (examples *Calystegia*, *Convolvus*), many tropical species are valuable ornamentals, medicinal, and food crops. The sweet potatoes *Ipomea batatas*, is the world's second most important crops [4]. The family Convolvulaceae is distinguishable by its plicate corolla, axile placentation with few ovules, bicollateral vascular bundles and latex usually present. It is a fairly advanced taxon [5-7] referred it to the order *Polemoniales*. The family has been fairly investigated in all domains of plant morphology; however, it has not been evaluated in recent times systematically and from the point of recent trends of researches [5]. Current knowledge of Convolvulaceae relationship is largely base on the work of [7-13]. Convolvulaceae can be recognized by their funnel-shaped and radially symmetrical corolla. The floral formula for the family has five sepals, five fused petals, five epipetalous stamens (stamen fused to the petals), and a two part syncarpous and superior gynoeceum. The stems of this plant are usually winding, hence their latin name, *convolvare*, meaning "to wind". The leaves are simple and alternate, without stipules. The fruit can be capsule, berry, or nut, all containing only two seeds per locule (one ovule/ovary). The leaves and tuberous roots of some species are used as foodstuffs (example sweet potato and water spinach), and the seeds are exploited for their medicinal value as purgatives. Some species contain ergoline alkaloids that are

Correspondence:
Okereke, C. N
Department of Applied Biology,
Ebonyi State University
Abakaliki, Ebonyi State.

likely responsible for the use of these species as ingredients in psychedelic drugs. The presence of ergoline in some species of this species of this family is due to infection of this family by fungi related to the ergot fungi of the genus *Claviceps* [2]. The typical members of the family are annual vines, with milky sap, internal (intraxylary) phloem, alternate, simple to lobed leaves, and actinomorphic, perfect hypogynous flowers. The corolla is sympetalous, often large and showy: stamens are epipetalous. The gynoecium is composed of two united carpels, unlobed, forming a two-locular, superior ovary, with 2-4 ovules. The precise delimitation has been controversial due to three lineages that do not share some of the above mentioned characters, but seem clearly allied with Convolvulaceae [3].

2. Materials and Methods

2.1 The Study Area

The study area was Ndufu Echara, Ikwo Local Government Area, Ebonyi State which is located within South-East Zone of Nigeria. The area is characterized by low-land (swamp), up-land, and few forests with abundant rainfall often within the raining season, and the people of the area engage more on food cropping and vegetable production among others.

2.2 Preliminary Studies

A preliminary study was made before the commencement of the field trip, in which the compilation of the general characteristics of the members of Convolvulaceae were made using publications, direct identification and other taxonomic literatures. In the course of the field trip, a total of eight members were identified.

2.3 The Specimen Collection

Despite different places visited for search and identification of the Convolvulaceae members, a total of three major sites were used for specimens' collection, viz: swampy area beside Mbukobe dam, Offia Awoke forest and along the road-side of Obuaegu Echara. The samples were collected using: knife (for cutting the specimens), pen and masking tape (for labeling), polythene bag (for carrying the samples collected), and measuring tape (for specimen measurement).

2.4 Taxonomic Study

The study observations were made based on random sampling technique of at least five plants in each of the different eight Convolvulaceae families aforementioned. The identified species were studied, measured and the observations were recorded.

2.5 Survey Design

On the basis of the study design, random sampling method was applied to distinguish different morphological features describing each species of Convolvulaceae families. The detailed study and the evaluation of the vegetative development as well as quantitative assessment of various morphological attributes such as the leaf length and breadth, plant length and length of successive internodes. The observations were recorded accordingly.

2.6 Statistical Methods

The observed raw data accrued from the measurement of different selected plant length, length of successive internodes, leaf length and breadth were analyzed using: Analysis of Variance (ANOVA) and confidence limit.

3. Result

Table 1: The Morphological Feature/Measurement of *Ipomoea Batatas* (Cm)

	Plant Length	Successive Internode	Leave Length	Leave Breadth	Flower Length
Plant I	65	62.7	64.9	27.2	3.8
Plant II	30	53.4	39.7	17.7	3.8
Plant III	150	61	70.3	32.2	4.5
Plant IV	98	60.8	37.1	24.4	3.5
Plant V	140	55.4	50.1	23.6	3.9

From the result shown in table 1 above, it was observed that plant III had the highest plant length of 150 cm, leaf length of 70.3, leaf breadth of 32.2 and the flower length of 4.5 cm followed by plant V which had a value of plant length which is

140 cm and flower length of 3.9 cm. The next is plant I which had the highest value of successive internodes. Plant IV had the least value of plant length of 30 cm, successive internodes of 53.4 cm and that of leaf breadth with the value of 17.7 cm.

Table 2: The Morphological Features of *Ipomoea Triloba* (Cm)

	Plant Length	Successive Internode	Leaves Length	Leaves Breadth	Flower Length
Plant I	164	14.82	17.72	13.70	4.5
Plant II	158	6.33	14.34	10.76	3.7
Plant III	168	6.94	10.24	7.96	3.9
Plant IV	120	5.33	2.22	1.52	3.8
Plant V	186	13.84	7.32	4.98	4.6

From the result shown in table II above, plant V was the highest in plant length (186 cm), in successive internodes (14.82), leaf length (17.72 cm) and leaf breadth (13.70 cm).

Plant IV is the least in plant length (120), successive internodes (5.33), leaf length (2.22) and leaf breadth (1.52 cm)

Table 3: The Morphological Features of *Ipomoea Involucrate*

	Plant Length	Successive Internode	Leaves Length	Leaves Breadth	Flower Length
Plant I	250	5.83	10.90	5.18	13.20
Plant II	450	10.80	15.50	8.40	15.40
Plant III	240	7.50	13.20	5.28	16.40
Plant IV	144	7.27	13.40	6.34	16.80
Plant V	210	7.35	11.00	3.01	13.20

From the result shown in table III above, it was observed that plant II had the highest result in plant length (450 cm), length breadth (8.40 cm), leaf length (15.50) and successive internodes (10.80 cm) plant IV showed the highest value of flower length

(16.80). Plant I had the least result in successive internodes (5.83cm) and plant V had the least result in leaf breath (3.01cm). Plant IV had the least value in plant length (144 cm)

Table 4: The Morphological Features of *Evolvulus Alsinoides*

	Plant Length	Successive Internode	Leave Length	Leave Breadth	Flower Length
Plant I	45	1.73	9.00	1.48	2.21
Plant II	28	1.31	1.70	0.94	1.34
Plant III	34	1.43	1.98	1.00	1.367
Plant IV	30	0.87	6.82	1.30	2.56
Plant V	36	1.69	5.54	1.12	4.08

From the result shown in table IV, it was observed that plant I had the highest value of plant length (45 cm), leaf breadth (9 cm) successive internodes (1.73 cm) and leaf breadth (1.48 cm). Plant V showed the highest value of flower length of 4.08 cm.

Plant II showed the least value in plant length (28 cm), leaf length (1.70 cm), leaf breadth (0.94 cm) and flower length (1.34 cm). Plant IV had the least value of successive internodes (0.87 cm).

Table 5: The Morphological Feature of *Ipomoea vagans*

	Plant Length	Successive Internode	Leave Length	Leave Breadth	Flower Length
Plant I	137	3.60	9.78	3.46	1.14
Plant II	97	2.95	6.30	3.30	1.70
Plant III	83	3.59	8.60	3.58	1.20
Plant IV	61	2.82	5.12	2.26	1.18
Plant V	102	2.89	8.64	3.46	1.16

From the result shown in table V above plant I showed the highest value in plant length (137cm), successive internodes (3.60cm) and leaf length (9.79). Plant III showed the highest value in leaf breadth. Plant II showed the highest result in

flower length. Plant IV showed least value in plant length (61cm), successive internodes (2.82cm), leaf length (5.12cm) and leaf breadth (2.26cm). Plant I showed least result in flower length (1.14cm).

Table 6: The Morphological Features of *Merremia aegyptia*

	Plant Length	Successive Internode	Leave Length	Leave Breadth	Flower Length
Plant I	149	9.20	21.40	10.80	5.90
Plant II	152	11.17	24.20	12.40	3.20
Plant III	105	10.30	23.40	12.40	2.76
Plant IV	90	8.80	80.50	5.90	2.54
Plant V	136	12.95	15.50	10.70	2.50

From the result shown in table VI, above plant I had the highest value in flower length (5.90 cm). Plant II and III showed a high value of leaf breadth (12.40 cm) in each of them.

Plant II showed highest in plant length (152 cm), plant IV showed the highest value in leaf length (10.80 cm) and showed the least in leaf breadth (5.90) and in plant length (90 cm).

Table 7: The Morphological Features of *Hewittia sublobata*

	Plant Length	Successive Internode	Leave Length	Leave Breadth	Flower Length
Plant I	136	5.78	9.32	3.86	5.6
Plant II	110	3.16	4.20	2.62	7.2
Plant III	145	4.16	3.70	3.40	6.4
Plant IV	120	6.35	8.82	5.56	5.2
Plant V	180	7.63	10.14	6.64	6.8

From the result shown in table VII, it was observed that plant V showed the highest value in plant length (180 cm), successive internodes (7.63 cm), leaf length (10.14 cm) and leaf breath (6.64 cm). Plant II showed the least value in plant

length (110 cm) and in leaf breadth (2.62 cm) but showed highest in flower length (7.2 cm). Plant III showed the least value in leaf length (3.70 cm) whereas plant IV showed the least value in flower length (5.2 cm).

Table 8: The Morphological Features of *Ipomoea eriocarpa*

	Plant Length	Successive Internode	Leave Length	Leave Breadth	Flower Length
Plant I	110	6.78	2.32	6.78	29.50
Plant II	50	3.36	1.24	3.36	16.00
Plant III	70	4.58	1.78	4.8	13.80
Plant IV	98	5.18	2.32	5.18	12.70
Plant V	62	4.46	1.60	4.46	12.50

Table 8 indicate that plant I showed the highest value in all the five parameters, plant length (110 cm), successive internodes (6.78 cm), leaf length (7.78 cm), leaf breadth (2.32 cm) and flower length (29.5 cm), plant II showed the least value in

plant length (50 cm), successive internodes (3.36 cm), leaf breadth (1.24 cm) and leaf length (3.36 cm). Plant V showed the least result in flower length (12.5 cm).

Table 9: Summary of the Morphological Features of Convolvulaceae Family.

Plant Name	Successive Internode	Leave Length	Leave Breadth	Flower Length
<i>I. Batata</i>	4.49 ± 6.29	2.2 ± 22.5	3.82 ± 5.4	3.69 ± 4.11
<i>I. triloba</i>	5.62 ± 13.28	5.2 ± 15.52	3.71 ± 11.85	4.65 ± 5.12
<i>Hewittia sublobata</i>	3.98 ± 6.84	4.66 ± 9.8	1.84 ± 7.98	5.56 ± 6.92
<i>I. Involucratea</i>	3.79 ± 11.71	11.17 ± 14.43	3.65 ± 7.63	13.65 ± 16.35
<i>Evolvulus alsinoides</i>	1.1 ± 1.7	2.4 ± 7.76	0.99 ± 1.33	1.33 ± 3.29
<i>Merremia aegyptia</i>	9.07 ± 11.89	12.25 ± 58.27	8.17 ± 12.71	0.5 ± 7.26
<i>I. vegans</i>	2.4 ± 8.74	6.61 ± 21.73	1.46 ± 7.88	3.19 ± 6.13
<i>I. eriocarpa</i>	1.04 ± 9.94	5.76 ± 15.50	8.78 ± 12.48	3.39 ± 19.77

4. Discussion

The study consists of five samples each of the eight different Convolvulaceae families, totaling forty study case samples. The comparative study of some members namely: *Ipomoea batata*, *Ipomoea eriocarpa*, *Hewittia sublobata*, *Merremia aegyptia* and *Evolvulus alsinoides* showed the major morphological difference basically on the leaf size and arrangement, nature of stem and internodes and floral color and morphology. The tropical and sub-tropical convolvulaceae family members have been observed to possess hairy/winding, creeping long stem with numerous internodes. Statistically, *Ipomoea batata* had plant length between (14-100 cm), *Ipomoea triloba* (120-186 cm), *Ipomoea vegans* (50-110 cm), *Ipomoea involucrate* (144-450 cm), *Merremia aegyptia* (90-152 cm), *Hewittia sublobata* (110-180 cm) and *Evolvulus alsinoides* (28-45 cm). At 95% confidence limit, the probability showed that the mean plants length ($X = 119$) lies between 93 and 145. However, their leaves appeared simple,

broad, though sometimes lobed and alternate without stipules in line with the statement of [3]. Generally, the members of convolvulaceae family have morphological differences or species uniqueness for easy identification.

The convolvulaceae are primarily of tropics and subtropics and also extends into North and South temperate regions of the world. The family contains about 50-60 species. It is distinguishable by its plicate corolla, axile placentation with few ovule, bicollateral vascular bundles and latex usually present. It is fairly investigated in all domains of plant morphology and also anatomically. However, it has not been evaluated in recent trends of researches. The family is best known in temperate regions for its weed representations. Many tropical species are valuable ornamentals, medicinal, and food crops. The sweet potato, *Ipomoea batata*, is a world second most important crop. Convolvulaceae could be recognized by their funnel-shaped, radially symmetrical corolla, the floral formula for the family has five sepals, five fused petals, five

epipetalous stamens (stamen fused to the petals), and two part syncarpous and superior gynoecium. The stems of the plant are usually winding, hence, the Latin name, *Convolvère* meaning “to wind”. The leaves are simple and alternate, without stipules. A fruit can be capsule, berry or nut, all containing only two seeds per one locule (one ovule/ovary). The early schemes of classification of the Convolvulaceae family were based mainly on one or few character. Characterization is very important in classification and naming a given family. Convolvulaceae as a broad family has certain differentiating characteristics which make them very unique and these characteristics enable one in assessing their morphology and in important ways in which the morphological and taxonomical characteristics of the Convolvulaceae family could be assessed.

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