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Corms as Additional Features to Identify Gladiolus Species Used in Ethnomedicine

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Abstract

Background: Plants remain vital as sources of traditional medicine towards management of various health challenges. Various parts such as leaves, stem bark, roots, flowers, and corms of different plants are utilized to manage a lot of human ailments. Proper identification of these plants together with their parts remain imperative for effective utilization**.** *Gladiolus* (Iridaceae) is a genus that consists of underground corms and has strikingly showy flowers. The corms are mostly rounded and symmetrically enveloped with fibrous tunics. Species in this genus are utilized widely to treat a number of diseases and health conditions. Presently the main and sure way to identify these plants is by use of their showy flowers; however, in Kenya, this becomes a challenge during dry seasons when the plants are not in flower.

Objective: This study investigated the use of features of corms as possible additional features for identification of *Gladiolus* species found in Kenya; *Gladiolus watsonoides*, *G. goetzenii*, *G. ukambanensis* and *G.newii*.

Method: Physical and histological features of corms were evaluated according to Rolls, 2011, to investigate for possible differences across the different species.

Results: Although the analysis of the cells of corms and leaves compared did not reveal any obvious differences, the outward morphologies of corms were different across different species in terms of colour, shape, and textures of the tunics.

Conclusion: Therefore, corms form an additional feature of taxonomic value for identification and collection of these plants in the absence of flowers.

Keywords: Gladiolus, Corms, Identification, Ethnomedicine

INTRODUCTION

Gladiolus is the second largest genus of Iridaceae family after *Iris* (Ameh *et al.* 2011). Of the 260 species recorded, 250 are native to South Africa and tropical Africa. These plants are erect with attractive showy flowers. They grow from rounded, underground symmetrical corms that are enveloped in several layers of brownish fibrous tunics. *Gladiolus* spp. have showy flowers of various shapes and colours such as pure white, cream, glossy red, orange, yellow and orange with markings or streaks (Agnew, 2013; Ochekpe *et al.*, 2009). Their showy flowers have made them contribute tremendously in the floriculture trade in most Asian countries where they are important cut-flowers. Many are also used as ornamentals in which case, the cut flowers are used for decorations, social functions, aesthetics and beauty (Ranjan, 2008; Riaz *et al.*, 2007; Ahmad and Siddique, 2005; Bose *et al*., 2003; Saifiula and Ahmad, 2001).

Several species of *Gladiolus* have also found usage in ethnomedicine in management of various ailments such as chest ailments, earaches, wounds, eyes, asthma , intestinal parasites, gonorrhoea (Ameh *et al.,*

2010; Odhiambo *et al.,* 2010;Yineger *et al.,* 2008). The parts utilized the most, are concoctions and decoctions prepared from corms. Biological assay tests records show that some of them have antibacterial activity (Fawole *et al.,* 2008), antifungal activity (Odhiambo *et al.,* 2010; Ameh et al. 2011; Nguedia *et al.* 2004), and anti-amoebic activity (Moundipa *et al*. 2005)

Apart from being edible, the corms are also used as food to prepare non alcoholic drink made from millet or sorghum, used to prepare soup as well.The flowers are also used as food, raw or cooked as vegetables, or used as salads (Delfield and Delfield 2007).

In view of the enumerated economic benefits of these species, it is crucial for correct identification to be done during collection for proper utilization.

In Kenya, there are four species of *Gladiolus* namely; *Gladiolus watsonoides, G.newii, G.ukambanensis, and G. goetzenii* . These are mainly differentiated using the aerial parts (Agnew and Agnew 1994) especially their strikingly different flowers because the other aerial vegetative features look largely similar. Flowering usually occurs shortly after the rains. There are real challenges in collection and identification during dry seasons when the plants are not in flower.

Gladiolus watsonoides Baker consists of bright glossy red flowers*, G.newii* Baker consists of flowers that are yellow orange without markings, *G.ukambanensis* has pure white flowers whereas *Gladiolus goetzenii* has bright orange flowers with markings (Agnew and Agnew 1994). This study investigated corms as additional features for identification of *Gladiolus* species. This was done by determining the internal and the outward morphology of corms.

MATERIALS AND METHODS

Collection and identification of plant materials

Gladiolus watsonoides was collected in August 2011 from Aberdares National park, through Wandare route towards Satima. *Gladiolus newii* was collected from Mt. Elgon in September, 2011 while *Gladiolus goetzenii* and *Gladiolus ukambanensis* were collected from Kinamba in Laikipia and Konza along Nairobi-Mombasa highway respectively in May 2012. All the plants were collected between the years 2011 and 2012. Entire plants were collected and identification done using keys (Agnew 2013; Agnew & Agnew 1994; Beentje ,1994) and by comparing with authentic herbarium materials at the University of Nairobi Herbarium. All the collected plants were in flower at the time of collection. Voucher specimens were deposited at the University of Nairobi herbarium.

Internal structural features of corms Preparation of slides from corms for micro-anatomy analysis

corms of each of the four plants freshly collected from the field were fixed by dipping in FAA (formalin acetic acid alcohol) to preserve cells and tissues in original form. These plant specimens were then dehydrated to remove water. This was done gradually and progressively in a series of alcohol and water solutions of increasing strength as follows; 70% ethanol (5min), 80% ethanol (5min), 100% ethanol (10min) (Rolls, 2011). The specimens were then dipped into a clearing agent xylene to make them more translucent. Each specimen was then embedded with paraffin wax to provide support during sectioning. During embedding, specimens were picked with forceps and transferred into a molten paraffin wax. The paraffin wax was given time to homogeneously solidify with each specimens within the wax *(*Rolls,2011*)*. The embedded specimens were sectioned into a series of thin slices by a cutting apparatus called a microtome. Carefully, the thin sections were transferred into surface of warm water (42°C) to enable them flatten. The sections were then picked from the water (mounted) using clean microscope slides and labelled. They were left overnight to dry (Rolls, 2011), then dipped in xylene for five minutes and 100%

ethanol to clear any traces of water and paraffin. The slides were put in Safranin stain bath for two hours. Water was ran over the slides to remove excess stain and dipped again in 100% ethanol to remove water. Fast green stain was applied for 10 seconds, then slides dipped in xylene with drops of 100% ethanol for 10 seconds and then dipped in xylene again for 1 minute to make the cells transparent (Rolls, 2011). These prepared slides were then photographed using an Olympus microscope a waiting interpretation.

Physical features of corms

The outward physical features of corms were evaluated. The evaluation focused on size, colour, shape and tunic colouration.

RESULTS AND DISCUSSION

Microanatomy of corms of *Gladiolus* spp. Investigated

At microanatomy level, prepared slides from corms showed no obvious differences amongst the cells from the different species. Slides from corms of all the plants generally showed parenchyma and collenchyma cells within which were visible starch granules (Figure 1B). Similarly, slides from leaves of all the plants had no obvious differences amongst them (Figure 1A). All the cells had epidermal, sclerenchyma, xylem and phloem similar in shape and location (Figure 1A).

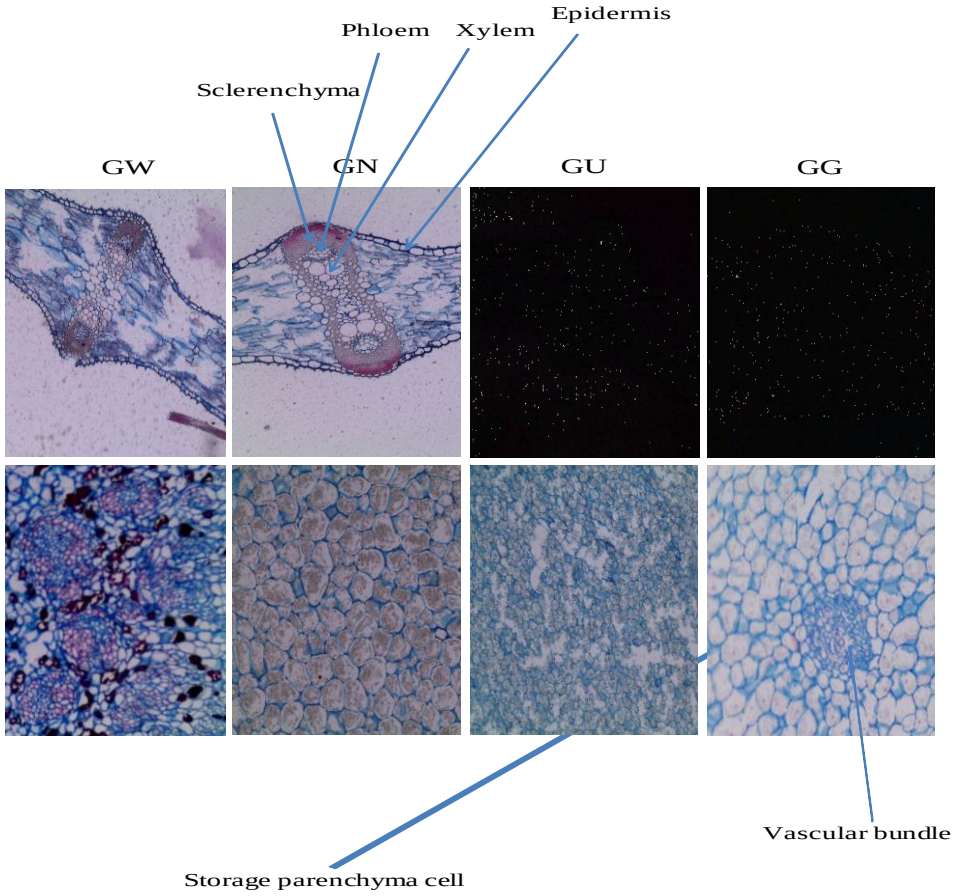

Figure 1: A photograph showing cross section of the internal structure of A: Leaves and B:corms. GW-*G.watsonoides*, GN-*G.newii*, GU-G.*ukambanensis*, GG-*G.goetzenii* at Mag×100. (Photo taken by Judith Odhiambo)

Physical features of corms

From outside analysis, corms of these plants had noticeable differences in shape, size, tunic colour and texture as shown.

G. watsonoides had one large main corm, deep brown in colour , tunic also deep brown, with 2 smaller ones attached (Figure 2)

Figure 2: A photograph of *G.watsonoides* showing the aerial parts with glossy red flowers and corms: Source (photo taken in 2011 by Judith Odhiambo)

Gladiolus newii had 2 corms with different tunics colouration. The main corm had papery tunic and creamish in colour while the lower smaller one appeared bright yellow (Figure 3).

Figure 3: A photograph of *G.newii* showing the aerials with yellow orange flowers and corms: Source (photo taken in 2011by Judith Odhiambo)

G. ukambanensis had two corms of similar size joined together. The two corms also had tunics creamish in colour. It was noted that this plant had tunics which were more fibrous that those of the other plants (Figure 4).

Figure 4: A photograph of G.ukambanensis showing the aerial parts with white flowers and corms: Source (Photo taken in 2012 Judith Odhiambo)

G. goetzenii had two corms, a main one and a minor one very small joined together. These corms had dark brownish papery tunic (Figure 5).

Figure 5: A photograph of *G.goetzenii* showing the bright orange flowers with markings and corms: Source (Photo taken in 2012 by Judith Odhiambo)

The taxonomic description *Gladiolus* species is mainly based on the morphological differences in aerial parts, particularly the flower features (Agnew, 2013; Agnew & Agnew, 1994). There is little information on the features of the corms that can be of use in differentiating the species.
During unfavuorable conditions, the flowers are usually absent which leads to challenges in collection and usage when only corms exist.

Corms are underground parts which plants use for water and nutrient storage for survival during their growth, especially in adverse environmental conditions (Michaels et. Al., 2022 a book). They consist of solid, fleshy and compressed stems with nodes, internodes and meristems. Roots of corms develop from basal plates and nodes, and are adventitious in nature. In *Gladiolus* , it has been noted that the corms may also be shortlived and hence regular replacement of corms (Michaels et. Al., 2022). Corms reproduce by asexual means through smaller corms called cormels or cormlets. Other examples of plants with corms include *Crocus sativus* (iridacea), Colocasia esculenta (araceae) and *Eleocharis dulcis* (cyperaceae) among others.

Whereas corms are also storage parts to facilitate growth during harsh conditions, many of them produce offshoots known as cormels or cormlets that also grow to mature plants. The differences in these corms may be useful in identifying the plants during non flowering seasons.

Among the four species of Gladioli found in Kenya, only *G.newii* has reports of usage in treatement of meningitis, malaria and diarrhoea (Odhiambo et al., 2010). Proper knowledge on how corms of different species look like may be useful for proper utilization.

Conclusion

The physical features described on the corms here, may be useful in the identification of different *Gladiolus* species where aerial parts are not available for instance during dry seasons or when the plants are not in flower.

These features which can be used to identify these plants in the absence of floral features have not been described before, however further molecular characterization are recommended as they may also be important in refining identification.

Conflict of interest; Authors have none to declare

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