

Kniphofia leucocephala (Asphodelaceae): a new white-flowered red-hot poker from South Africa

H. Baijnath

Herbarium, Botany Department, University of Durban-Westville, Private Bag X54001, Durban, 4000 Republic of South Africa

Received 31 March 1992; revised 30 June 1992

Kniphofia leucocephala Baijnath, from the Zululand region, is described. It is a white-flowered species which may be included in section 3 of Codd's groupings within the genus. It is closely related to *K. pauciflora* Bak., but differs markedly in floral and vegetative characters. Some of these characters are illustrated and discussed.

Kniphofia leucocephala Baijnath van die Zoeloeland-gebied word beskryf. Die spesie het wit blomme en kan in seksie 3 van Codd se groeperings in die genus geplaas word. Dit is naverwant aan *K. pauciflora* Bak., maar verskil aanmerklik wat blom- en vegetatiewe kenmerke betref. Sommige van hierdie kenmerke word geïllustreer en bespreek.

Keywords: Anatomy, Asphodelaceae, flowering, *Kniphofia*, taxonomy.

Introduction

In 1970, Mr R.G. Strey collected a white-flowered species of *Kniphofia* Moench (Strey No. 9916) from the Richards Bay area of Zululand. These herbarium specimens were examined by Dr L.E. Codd (Codd 1989) who indicated that there was a resemblance between this gathering and the very rare species, *K. pauciflora* Bak., which occurred in the Durban area. Dr Codd considered that this white-flowered entity might be 'worthy of separate status of some sort' but did not explore it further, probably because of very limited material. There was, therefore, great excitement when a local horticulturist, Mr Wally Menne, informed me about the presence of a white-flowered red-hot poker in Zululand. On investigation, it was discovered that these plants of the Langepan population in Kwa-Mbonambi were identical to those collected by Mr Strey in the Richards Bay area. It also emerged that this entity is new to science.

In this paper, this new species is described, and additional information from other fields of study is given.

Description

Kniphofia leucocephala Baijnath sp. nov., *K. pauciflorae* Bak. affinis sed folius valde 'V'-formis, inflorescentiis densis, floribus albis, pedicellis brevioribus atque stylis filamentisque maius exsertis differt.

Kniphofia leucocephala Baijnath sp. nov., related to *K. pauciflora* Bak., but differs in exhibiting markedly 'V'-shaped leaves, dense inflorescences, white flowers, shorter pedicels and a greater exsertion of styles and filaments.

TYPUS:— South Africa: Natal: Zululand, 12 km east of Kwa-Mbonambi, Langepan plantation, 1990-12-14, *Baijnath 2502* (UDW, holotypus; K, MO, PRE, isotypi).

Plants shortly stoloniferous, forming tight tufts about 50 mm in diameter, with 4 – 7 aerial groups of leaves. *Roots* yellow, originating from around the base of the growing point, up to 150 mm long, ca. 5 mm wide, tapering towards the tips (Figure 1). *Leaves* 3 – 6 at each growing point, green to glaucous green, channelled above and keeled

below, 'V'-shaped in cross-section at midway, with angles of 'V' greater than 90°, soft, in general upright, 470 – 630 mm long, 4 – 7 mm wide, gradually tapering to a point at the apex, margins with fine bead-like outgrowths in the upper third, smooth on the lower part and on the keel. In general, up to 4 dried leaves present at each growing point; basal leaf remains sometimes present as filiform fibres up to

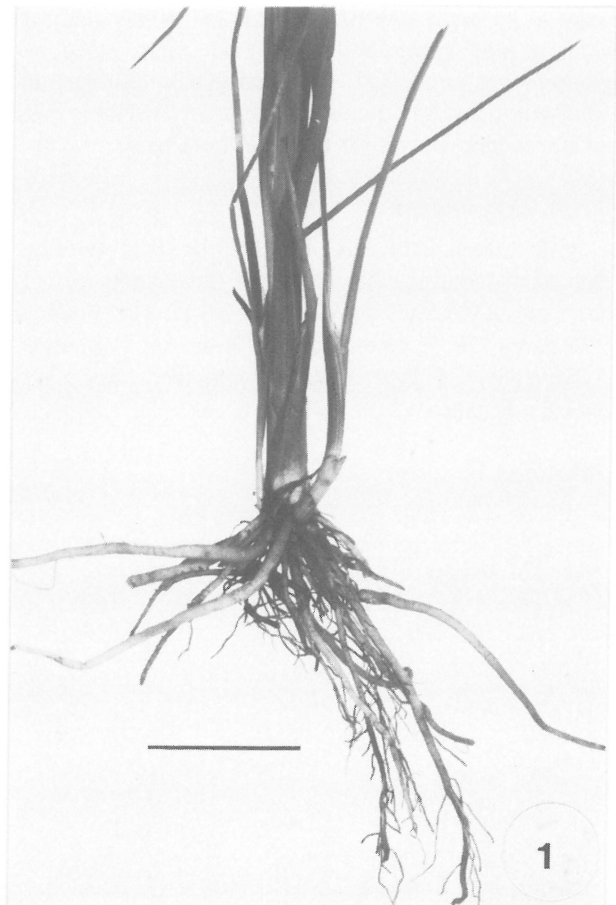


Figure 1 Basal portion of *K. leucocephala* illustrating roots and young shoots. Scale bar: 100 mm.

60 mm long. *Peduncle* upright, usually overtopping or subequal to the leaves, 450 – 600 mm long, 3 – 5 mm broad, pinkish or brownish green with usually a single sterile bract below the inflorescence and a coma of white bracts at apex. *Inflorescence* ovoid to rhomboid at mid-flowering stage, 45 – 50 mm long, 38 – 46 mm wide; buds, bases and lower half yellowish green, whitish green, green, greenish orange, reddish brown, yellowish brown, pinkish brown, pinkish white, pinkish purple or greenish brown; upper half in general white, in very young stage buds directed upwards, with maturity directed almost at right angles to axis and finally directed towards the base during the pre-anthesis, anthesis (Figure 2) and post-anthesis periods, mature flowers white. *Bracts* ovate, somewhat boat-shaped, 5 – 6.5 mm long, 3.5 – 4.5 mm wide, white, translucent, with central brown nerve terminating about one-third before the apex, each margin with 3 – 4 large teeth with acute apices, apex acute or slightly obtuse. *Pedicels* 2 – 2.5 mm long, ca. 0.5 mm wide, increasing to 3.5 – 4 mm long, 1 – 1.5 mm wide at fruiting. *Perianth* funnel-shaped, slightly curved, 20 – 23 mm long, ca. 2 mm wide from base to about midway, then broadening to ca. 7 mm at mouth (Figure 3); lobes spreading almost at right angles to the tube, ca. 3 mm long, ca. 3.5 mm wide, outer lobe tapering gradually to obtuse apex, inner lobe with apex rounded or emarginate. *Stamens* of two lengths, longer series opposite inner perianth lobes, exerted by 7.5 – 10 mm, shorter series opposite outer perianth lobes, exerted by 3.5 – 5 mm; filament ca. 0.35 mm in diameter; anthers ca. 1.5 mm long, ca. 0.7 mm wide; in senescent flowers all filaments withdrawn

with anthers located at mouth of perianth tube. *Ovary* ovoid, 2.5 – 3 mm long, 1.5 – 2 mm wide; style 27 – 32 mm long, 0.4 mm wide, at stigma receptivity exerted by 8 – 10 mm, tapering very gradually towards the apex; stigma small, papillate. *Capsule* broadly ovoid (Figure 4), 6 – 7 mm long, 5 – 6 mm wide, directed upwards, dehiscence loculicidal; seeds 4 – 7 per capsule, brownish black, deltoid, margin rarely with narrow wing.

Discussion

It is quite evident from recent taxonomic treatments (Codd 1968; Marais 1973) that several species of the genus *Kniphofia* are restricted to wetland areas. In general, these habitats support a unique flora which is sensitive especially to edaphic changes. In recent years, wetlands have received much attention in South Africa and, despite organized efforts towards their conservation, many of their flowering plants are being threatened. It is of great concern that the new species, *K. leucocephala*, together with other associated plants, are constantly threatened by the rigours of afforestation.

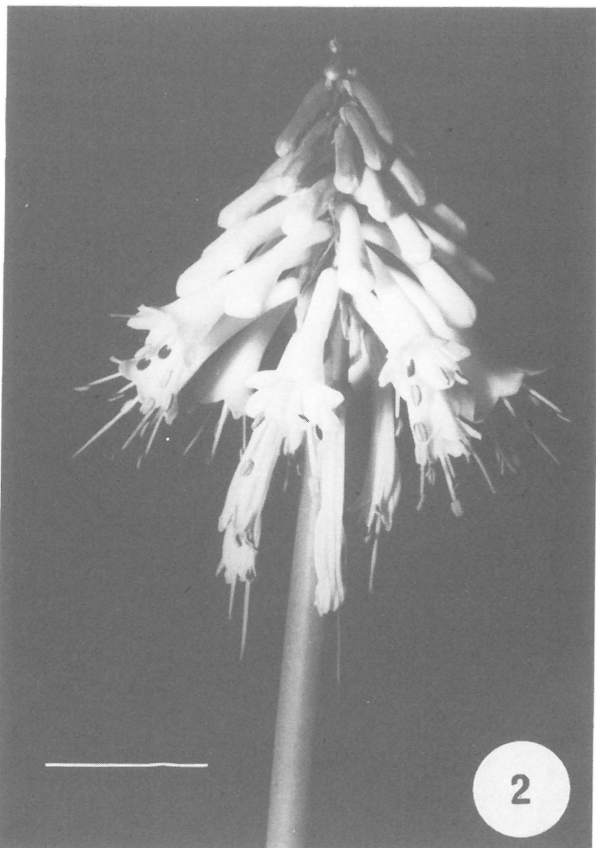


Figure 2 Illustration of inflorescence of *K. leucocephala* with flowers at anthesis stage. Scale bar: 16 mm.

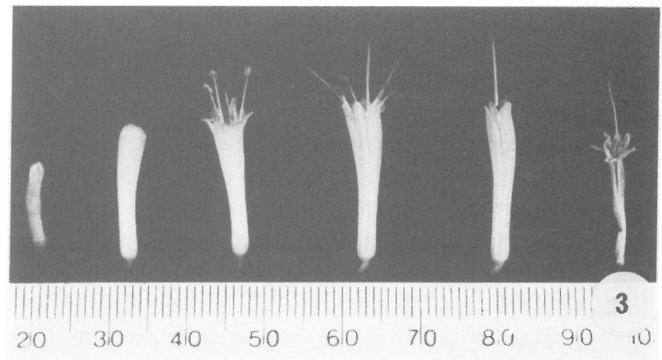


Figure 3 A developmental series illustrating different stages of floral maturity in *K. leucocephala*. Scale units in millimetres.

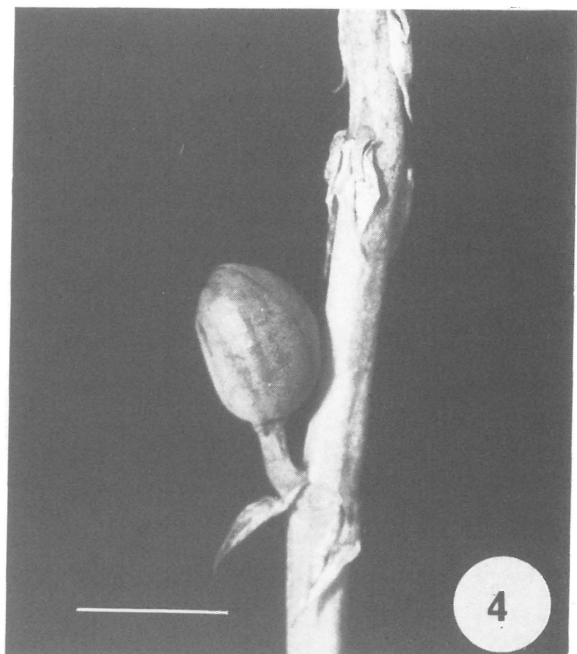


Figure 4 Mature undeveloped capsule in *K. leucocephala*. Scale bar: 7 mm.

tion. The closely related species, *K. pauciflora*, which flourished in moist low-lying grasslands in and around Durban, is apparently extinct in the wild. This species is known only from cultivated plants that were originally collected by the author from a native population. As much as it would appear that the future of the type locality of *K. leucocephala* is not being threatened, it should be emphasized that the plants at the initial locality in Richards Bay (Strey No. 9916) probably do not exist now.

On the basis of a single gathering of plants now recognized as *K. leucocephala*, Codd (1989) indicated that there is a strong similarity between this species and *K. pauciflora*. However, detailed observations of wild and cultivated plants of both taxa highlighted their differences (see Table 1). Observations of plants growing under field and glasshouse conditions show that the flowering times of both species overlap and this presented the opportunity to undertake a preliminary selfing and crossing experiment. It was found that both species are predominantly self-incompatible. However, it was found that seeds from selfed flowers in *K. leucocephala* germinated easily whereas similar seeds from *K. pauciflora* did not germinate. In the crossing experiment (involving 74 flowers) between *K. leucocephala* (female) and *K. pauciflora* (male), 22% of the flowers formed capsules. A germination test indicated a viability of 50%. The reciprocal cross (involving 34 flowers) indicated that 15% of the flowers successfully formed capsules. However, germination tests of seeds from this cross were negative. Presently some hybrid plants from the viable seeds are in cultivation and ought to reach maturity soon. At that stage both the parents and their offspring will be studied in detail.

An assessment of pollen fertility in both species was made by staining pollen grains in a mixture of cotton blue and lactophenol. Fertile grains stained dark blue while

sterile grains tended to be malformed and unstained. Percentage calculations based on an examination of 500 grains indicated a pollen fertility of 94% in *K. leucocephala* and 66% in *K. pauciflora*. The implications of these findings are not yet clear. However, the low fertility in *K. pauciflora* does not augur well for the survival of this species which is considered to be one of the rarest in the genus (Codd 1989).

Previous research (Bajinath 1980, 1987) has indicated that several anatomical characters, including leaf shapes in transverse sections, are useful in demarcating species in the genus *Kniphofia*. In the above study, all the samples for examination were prepared at a standard level halfway between the base and the apex. The exact position of sampling is very critical as is evident from a comparison of the shapes illustrated from fresh leaves of *K. pauciflora* (Figure 5, A – C) and *K. leucocephala* (Figure 5, D – F). In an earlier paper, Codd (1968) described the leaves of *K. pauciflora* as 'more or less triangular in cross-section', and in a subsequent publication (Codd 1989) as 'V'-shaped in cross-section. This discrepancy could be explained by examining the illustrations from a single leaf of *K. pauciflora* sampled at three different levels (Figure 5, A – C). The leaf here is 'V'-shaped at the base, triangular to triquetrous at the midpoint and flattened-keeled towards the apex. A comparison of the leaves of *K. pauciflora* and *K. leucocephala* at the three selected levels emphasizes the diagnostic value of leaf shapes. Despite the similarity between these species at the basal end, the distinct adaxial groove in *K. leucocephala* (Figure 5F) clearly separates this species from *K. pauciflora* (Figure 5C). Nevertheless, a detailed anatomical study of *K. leucocephala*, as done earlier in other species (Bajinath 1980), needs to be undertaken. Although outlines of leaf shape in transverse section have been regularly used in demarcating species, it is important to note that for valid comparisons, adult leaves must be selected and sections should be prepared from a standard level, as suggested earlier.

Observations under field and glasshouse conditions were

Table 1 Salient diagnostic features of *K. pauciflora* and *K. leucocephala*

	<i>K. pauciflora</i>	<i>K. leucocephala</i>
Leaf margin	serrulate, teeth pointing forward	small bead-like outgrowths
outline (t.s.-midway)	triangular	'V'-shaped
Inflorescence	generally lax, sometimes slightly dense, nodding	very dense, upright
Bud colour	greenish yellow	various
Flower colour	yellow	white
Bract		
l × b (mm)	5 – 6 × 1 – 2	5 – 6.5 × 3.5 – 4.5
shape	lanceolate to narrowly lanceolate	ovate
Pedicle length (mm)		
in flower	2.5 – 5.5 × 0.5	2 – 2.5 × 0.5
in fruit	6 – 7.5 × 1	3.5 – 4 × 1 – 1.5
Perianth length (mm)	14 – 18	20 – 23
Filament exertion (mm)		
inner series	2 – 3	7.5 – 10
outer series	ca. 1	3.5 – 5
Style exertion (mm)	2 – 3	8 – 10

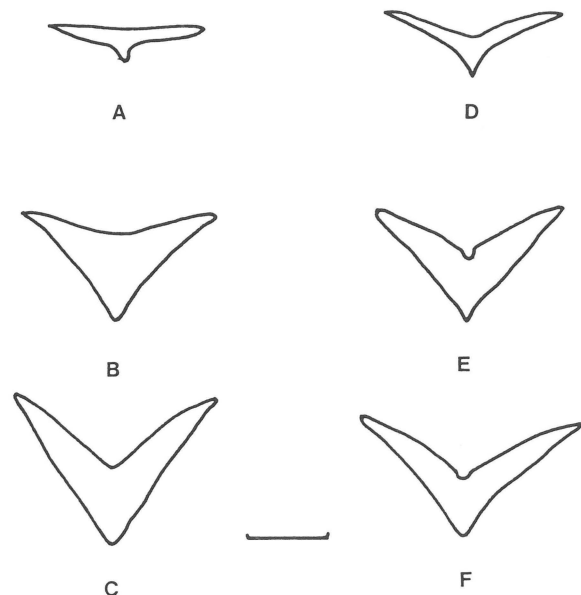


Figure 5 Outlines of transverse leaf sections in *K. pauciflora* (A – C) and *K. leucocephala* (D – F). A & D: apex; B & E: midway; and C & F: base. Scale bar: 2 mm.

not conclusive about the flowering times in this species. During December 1990, when the population was visited, a few heads were in full flower. It was also clear that some flowering had taken place earlier in November. Specimens introduced to glasshouse conditions continued flowering and these plants flowered again during February to March 1991, and also in June of that year.

Data on flowering phenology were accumulated from plants kept under glasshouse conditions and it was assumed that the same pattern would apply under natural conditions. Flowers of *K. leucocephala* are markedly protandrous, as in most of the other species in the genus. Bud-break occurs either early in the morning or early in the evening. Following bud-break in a particular flower, the anthers dehisced in the longer set of stamens after 10.5 h and in the shorter set after 12 h. Filaments were fully extended 24 h following bud-break and at that stage the flower was faintly scented. Stigmatic papillae were initiated a few hours later. The stigmatic exudate was noticeable after a period of 51 h following bud-break. The receptive period of the stigma lasted for about 8 h. Observations in *K. leucocephala* have indicated that the time span between bud-break and the initiation of flower senescence is about three days.

From these observations certain trends may be suggested about the breeding pattern in *K. leucocephala*. It is clear that the marked protandry and self-incompatibility favour outbreeding. The white colour of the perianth together with the presence of a faint scent, especially in the evening, could suggest visitation by moths. However, the apparent lack of nectar as a reward tends to disfavour this suggestion. It would seem that visitation by insects during the day for pollen would explain most of the successful seed set.

From published information (Codd 1968; Marais 1973), it appears that scent as a floral reward is almost non-existent in the genus. However, a small group of four species [*K. brachystachya* (A. Zahlbr.) Codd, *K. parviflora* Kunth, *K. typhoides* Codd and *K. umbrina* Codd] with brownish or yellowish (*K. parviflora*) short flowers, is characterized by a faint sweet scent. It is obvious that these four species may share a common group of pollinators. A study of the floral biology and pollination of this group may assist in understanding the significance of scent and coloration in the

genus. Also, the presence of scent in *K. leucocephala* further emphasizes the need for a careful examination of the other white-flowered species in the genus.

The sets of characters exhibited by *K. pauciflora* and *K. leucocephala* are sufficiently distinct to maintain them as separate species. Most of these characters have been discussed already and Table 1 shows the salient diagnostic features of the two species.

Specimens examined

—2832 (Mtubatuba): Richards Bay (–CA), 1970–09–04, *Strey 9916* (NH, PRE); Kwa-Mbonambi (–CC), Langepan plantation, 1990–12–14, *Baijnath 2502* (UDW, K, MO, PRE); Mzingazi Lake, 1970–09–09, *Venter 5986* (PRE).

Acknowledgements

Financial support from the Foundation for Research Development and the University of Durban-Westville is appreciated. I am grateful to the curator of NH for the loan of specimens and to the Department of Forestry for the necessary permits to study living material. I thank Mrs L. van Hooff and Mr C.J. Ward for photographic assistance, and Dr H.F. Glen for help with the Latin diagnosis. I am grateful to Mr Wally Menne for his hospitality, interest and assistance.

References

- BAIJNATH, H. 1980. A contribution to the study of leaf anatomy of the genus *Kniphofia* Moench (Liliaceae). In: *Petaloid Monocotyledons*, eds. C.D. Brickell, D.F. Cutler & M. Gregory, *Linn. Soc. Symp. Ser.* 8: 89 – 103. Academic Press, London & New York.
- BAIJNATH, H. 1987. *Kniphofia albomontana* (Asphodelaceae): A new caulescent species from South Africa. *S. Afr. J. Bot.* 53: 307 – 310.
- CODD, L.E. 1968. The South African species of *Kniphofia*. *Bothalia* 9: 363 – 513.
- CODD, L.E. 1989. *Kniphofia pauciflora*. *Flower. Pl. Afr.* 50(2): Pl. 1995.
- MARAIS, W. 1973. A revision of the tropical species of *Kniphofia* (Liliaceae). *Kew Bull.* 28: 465 – 483.