

## 10 Finger Millet

Mathews M. Dida<sup>1</sup> and Katrien M. Devos<sup>2</sup>

<sup>1</sup> Department of Botany and Horticulture, Maseno University, Private Bag, Maseno, Kenya,  
e-mail: mitodida@yahoo.com

<sup>2</sup> Department of Crop and Soil Sciences and Department of Plant Biology, University of Georgia, Athens, GA 30602, USA

### 10.1 Introduction

Finger millet, *Eleusine coracana* Gaertn L., is a cereal grown for food in Africa and Southern Asia, mainly India (the states of Uttar Pradesh, Bihar, Tamil Nadu, Karnataka, and Andhra Pradesh) and Nepal. In Africa, the crop is principally grown in the eastern regions, mainly in Uganda, Kenya, and Tanzania and, to a lesser extent, in Ethiopia, Rwanda, Malawi, Sudan, Zambia, and Zimbabwe.

#### 10.1.1 Brief History of the Crop

Finger millet originated and was domesticated in Africa. Archeological and linguistic evidences show that around 5,000 years ago, farming communities in eastern Africa were already cultivating this millet (Klichowska 1984). The exact area of domestication is unknown, and it has been suggested that it may have occurred anywhere between western Uganda and the Ethiopian highlands of Eastern Africa (de Wet 1995). From Africa the crop was transported to India about 3,000 years ago, whereupon the subcontinent became its secondary center of diversity.

Cultivated finger millet (*Eleusine coracana* subsp. *coracana*) is likely to have been derived from selection and domestication of a large-grained mutant of the wild *E. coracana* subsp. *africana*. Evidence for the ancestry of cultivated millet has been provided by cytological (Hiremath and Salimath 1992), morphological (Hilu and de Wet 1976), and molecular data (Dida 1998; Hilu 1988).

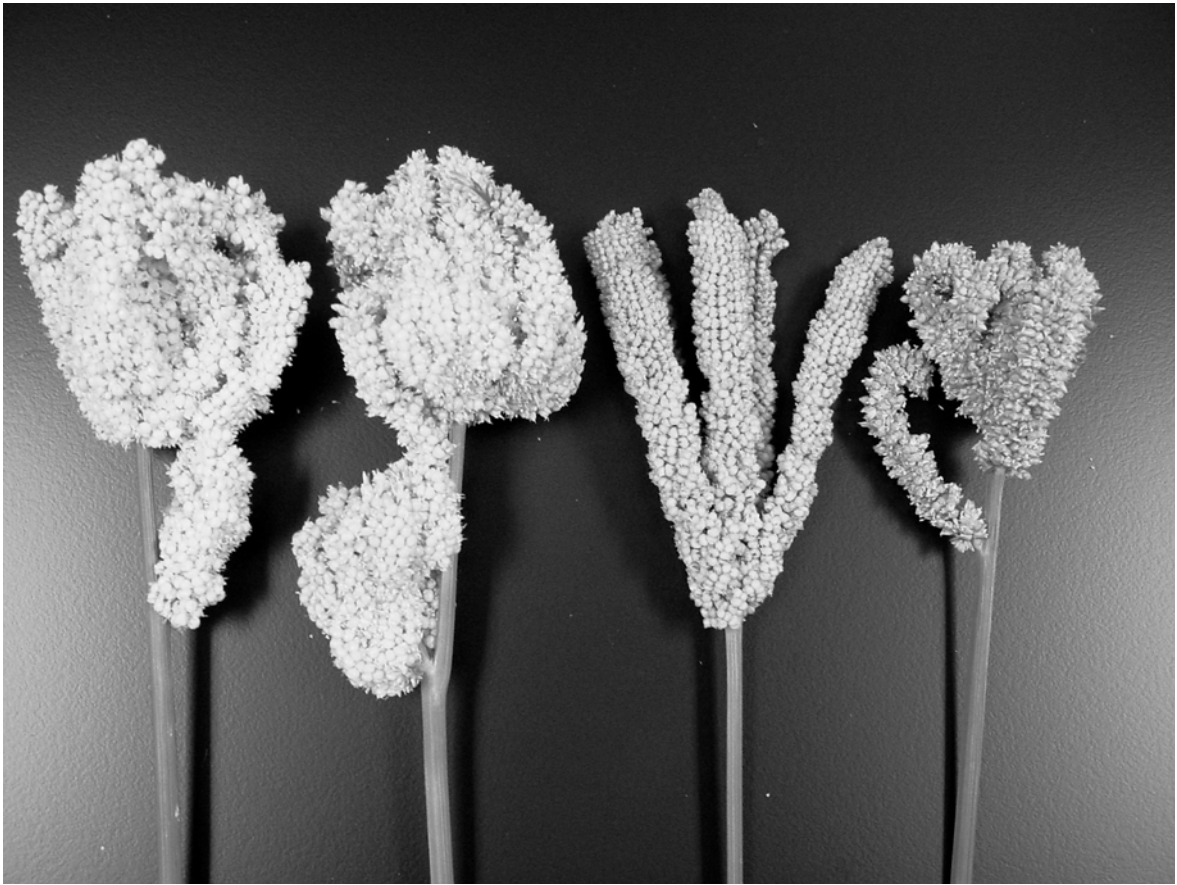
#### 10.1.2 Botanical Descriptions

Finger millet (*E. coracana*) and related species belong to the subfamily Chloridoideae within the Poaceae

family. The crop belongs to the genus *Eleusine*, which contains eight species, both annuals and perennials. Finger millet is a tufted annual growing from about 40 to 150 cm tall and takes from 3 to 6 months to mature. The stems are erect, compressed, and glabrous. The leaf blades are linear and taper to an acute point, folded, and striated and often have ciliated margins (Rachie and Peters 1977). The inflorescence consists of a variable number of spikes ranging from 3 to 20 arranged in a bird's foot style. It resembles fingers on a hand, hence its common name "finger millet". Each spike contains about 70 spikelets arranged alternately on the rachis, and each spikelet carries 4 to 7 seeds. The seeds vary in diameter from 1 to 2 mm. The caryopsis (seed) is globose and smooth, and the color can be brown, reddish brown, black, orange red, purple, and white (J. Duke, 1983, Handbook of Energy Crops. Unpublished, Purdue University).

The morphology of the finger millet inflorescence is highly variable and may be a consequence of farmers' selection preferences (de Wet 1995). Based on the inflorescence morphology, finger millet can be grouped into five races. The race *coracana* resembles the subspecies *africana* and has well-developed central spikes numbering from 5 to 20. The spikes are straight, slender, and up to 11 cm in length. The race *vulgaris* has inflorescences with incurved or straight spikes (Fig. 1). The *compacta* race (Cockscomb finger millet) has incurved spikes with lower finger branches divided in compacta. The lower inflorescence branches usually present in Indian cultivars may not be present in some African cultivars (Fig. 1). The race *plana* has large spikelets arranged in two even rows along the rachis, giving the head a ribbonlike appearance, and the *elongata* race has long slender spikes that are incurved at maturity, with lengths of up to 24 cm.

Finger millet (*Eleusine coracana* subsp. *coracana*) and the weedy wild relative *E. coracana* subsp. *africana* are allotetraploids with  $2n = 4x = 36$



**Fig. 1.** Variation of finger millet head shapes. The first and second from *left* belong to the race *Compacta*, the third and fourth belong to races *Coracana* and *Vulgaris*, respectively

chromosomes. These two subspecies have been assigned the genomic notation AABB (Chennaveeriah and Hiremath 1974; Hiremath and Salimath 1992). It has been established that the diploid *E. indica* (wild goosegrass) is the source of the A genome in finger millet (Hilu 1988; Hiremath and Salimath 1992; Dida 1998; Bisht and Mukai 2001a). The source of the B genome, however, has not been unequivocally established. The results of recent genomic in situ hybridization studies suggest that the perennial *E. floccifolia* may be the B genome donor to both cultivated finger millet and the subspecies *africana* (Bisht and Mukai 2001a,b). Cultivated finger millet is cross-compatible with the wild subspecies *africana* and with another allotetraploid, *E. kigeziensis* ( $2n = 4x = 38$ ) (Hiremath and Salimath 1991). These two wild allotetraploids are confined to the African continent with *E. kigeziensis* being endemic to southwestern Uganda (Kabale district) and Rwanda (Phillips 1974).

There are limited reports on the DNA content of finger millet and related species. A review by Bennett and Leitch (1995) reported that cultivated finger millet had a 2C (diploid) nuclear DNA content of 5.5 picograms (pg), whereas the wild subspecies *africana* had a value of 5.1 pg. These values were determined on root nuclei using a microdensitometry method with onion (*Allium cepa*) as standard (Hiremath and Salimath 1991). Later, another report of DNA contents of *Eleusine* species using laser flow cytometry and chicken red blood cell nuclei as standard gave comparatively lower values (Mysore and Baird 1997). Mysore and Baird reported 2C nuclear DNA value of 3.6 pg and 3.3 pg for *E. coracana* and *E. africana*, respectively. These authors further postulated that the earlier reported DNA values may have been overestimated owing to the use of onion with higher DNA content as standard and a frequent occurrence of root endopolyploidy. Based on these reports,