

Morphology and distribution of Zerazera sorghums

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Résumé

On trouve les sorghos zérázéra au Soudan et en Ethiopie. En raison de leur qualité agronomique exceptionnelle, ils ont une place importante dans les programmes d'amélioration du sorgho en Inde et ailleurs. De nombreuses collections de sorghos zérázéra ont été constituées par l'ICRISAT au Soudan et en Ethiopie respectivement en 1979 et 1981. Les similitudes morphologiques, la distribution géographique et la répartition ethnique des zérázéra du Soudan et de l'Ethiopie permettent de supposer que ces sorghos furent introduits au Soudan dans la zone Gambella en Ethiopie. En dépit de quelques différences, on peut regrouper les sorghos zérázéra du Soudan et de l'Ethiopie dans la sous-espèce Zérázéra du genre Caudatum.

Abstract

Zerazera sorghums are distributed in Sudan and Ethiopia. Because of their agronomic eliteness zerazera sorghums are used extensively in several sorghum improvement programs in India and elsewhere. Extensive collections of zerazeras were made in Sudan and Ethiopia by ICRISAT in 1979 and 1981 respectively. Morphological affinity, geographic distribution and the ethnic association of the Sudan and Ethiopian zerazeras suggest that zerazera sorghums were introduced from Sudan into the Gambella area of Ethiopia. In spite of slight differences, zerazera sorghums from Sudan and Ethiopia can be grouped as subrace Zerazera under race Caudatum.

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MORPHOLOGY AND DISTRIBUTION OF ZERAZERA SORGHUMS

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Résumé. — On trouve les sorghos zérázéra au Soudan et en Ethiopie. En raison de leur qualité agronomique exceptionnelle, ils ont une place importante dans les programmes d'amélioration du sorgho en Inde et ailleurs. De nombreuses collections de sorghos zérázéra ont été constituées par l'ICRISAT au Soudan et en Ethiopie respectivement en 1979 et 1981. Les similitudes morphologiques, la distribution géographique et la répartition ethnique des zérázéra du Soudan et de l'Ethiopie permettent de supposer que ces sorghos furent introduits au Soudan dans la zone Gambella en Ethiopie. En dépit de quelques différences, on peut regrouper les sorghos zérázéra du Soudan et de l'Ethiopie dans la sous-espèce *Zérázéra* du genre *Caudatum*.

Abstract. — Zerazera sorghums are distributed in Sudan and Ethiopia. Because of their agronomic eliteness zerazera sorghums are used extensively in several sorghum improvement programs in India and elsewhere. Extensive collections of zerazeras were made in Sudan and Ethiopia by ICRISAT in 1979 and 1981 respectively. Morphological affinity, geographic distribution and the ethnic association of the Sudan and Ethiopian zerazeras suggest that zerazera sorghums were introduced from Sudan into the Gambella area of Ethiopia. In spite of slight differences, zerazera sorghums from Sudan and Ethiopia can be grouped as subrace *Zerazera* under race *Caudatum*.

Zerazera is the local name of a landrace of *Sorghum bicolor* (L.) Moench (grain sorghum) cultivated in the eastern region of the Sudan (PRASADA RAO and MENGESHA, 1981). Plants belonging to this race are 1.5-2.0 m tall, mostly with plants of tan color, which makes them distinct in the field. Grain shape is somewhat turtle-backed, and of the caudatum type (HARLAN and DE WET, 1972). Phenotypes similar to zerazeras from Sudan were reported by Snowden as *Zerzereih*, *Ziriziri* and *Zereizira* and were classified under *Sorghum caudatum* Stapf var. *durum* (SNOWDEN, 1936). They were extensively grown in the Sudan close to Gedarif and Khartoum. The name zerazera was adopted as a work-group to describe and classify a small number of similar landraces from Sudan (MURTY *et al.*, 1967). Several landraces distributed in the Gambella area of Western Ethiopia that borders onto Sudan also belong to zerazeras (PRASADA RAO and MENGESHA, 1982).

Zerazera sorghums were used extensively in several sorghum improvement programs in India and other countries (NARAYANA *et al.*, 1977). To increase the

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germplasm of zerazera sorghums, extensive collections were made in Sudan in 1979 and Ethiopia in 1981. Morphological affinity, geographic distribution and ethnic association of the Sudan and Ethiopian zerazeras are reported in this paper.

COLLECTION OF ZERAZERA SORGHUMS IN SUDAN AND ETHIOPIA

The collection mission in eastern Sudan was organised by ICRISAT in collaboration with the Ministry of Agriculture, Government of Sudan. Local informants suggested that zerazera sorghums were under cultivation in Sudan a decade ago but are no longer grown. However, a few zerazera sorghums were collected on the bank of the Blue Nile close to Damazin. This land race is on the verge of extinction in the Sudan (PRASADA RAO and MENGESHA 1981). The mean annual rainfall around Damazin is 730 mm. The altitude is 450 m and the soils are predominantly black clay. Sorghum is the principal crop grown in this area. Landraces such as Dabar and Feterita are rapidly replacing zerazera sorghums because they are less susceptible to bird damage.

Landraces morphologically similar to zerazeras of the Sudan are present in the Ethiopian sorghum germplasm collected by the Ethiopian Sorghum Improvement Project (ESIP) Nazareth, and sent to ICRISAT in 1973. These were collected in the Gambella area of Western Ethiopia bordering Sudan. Motivated by the danger of zerazera germplasm erosion, a pointed collection mission was launched by ICRISAT in the Gambella area in collaboration with the Ethiopian Sorghum Improvement Project (ESIP), the Plant Genetic Resources Center (PGRC/E), and the International Board for Plant Genetic Resources (IBPGR) (PRASADA RAO and MENGESHA 1982).

Gambella is the largest awraja (region) in the Illubabor Administrative Region of Ethiopia. The topography, unlike most of Ethiopia, is relatively flat with an altitude of approximately 500 m. The banks of the seasonally flooded rivers Baro, Siru, and Aloro are mainly planted with sorghum. Caudatum sorghums are predominantly grown, the most important among them being the zerazeras. They are locally known as **Ganga**, **Juwalum** and **Uteedit**. Soils are alluvial, and the mean annual rainfall is 1270 mm. Rainfall occurs between April and November. Gambella is one of the hottest areas in Ethiopia with a maximum temperature of 44 °C recorded in the months of March and April. 64 samples of zerazera sorghums, with a range of variation in panicle shape and glume color, were collected from this area (PRASADA RAO and MENGESHA 1982).

MORPHOLOGY

Panicle and spikelet shape of zerazera sorghums place them in race *caudatum*, but the grain asymmetry is somewhat different. Grains are biconvex rather than turtle shaped, and are exposed at maturity between the short glumes. The style often persists at the tip of a beak on the grain that points towards the lower glume. Culms are stout,

1.5-3.0 m high, 2-3 cm wide near the base, and mostly tan in color. Leaves on a culm number 8-15, blades are 0.5-1 m long and 5-10 cm wide. Midrib color is usually white. Peduncle is erect and more or less stout, with rachises more or less continuous throughout the panicle. Pedicelled spikelets are male or neuter, linear, 4-6 mm long and about 1 mm wide, and deciduous. Sessile spikelets are elliptic-oblong, 3.5-5.5 mm long, and 2.5-3.0 mm wide when in flower. Glumes are coriaceous with nerves hardly visible near the tip. Grains are 3.0-4.0 mm wide, and yellow, cream, or dull white in color. Endosperm is highly corneous, flinty and white to yellow in color. The subcoat is not colored. The grain is easily separable from the spikelet. An evaluation of zerazera sorghums from Sudan and Ethiopia for some morphological and agronomic characters is shown in Table 1. Zerazera sorghums are photoperiod sensitive and behave as restorers on milo cytoplasm.

TABLE I. — Some morpho-agronomic characters of zerazera sorghums from Sudan and Ethiopia evaluated at ICRISAT center, Patancheru, India.

Character	Mean		Standard deviation		Range	
	Sudan	Ethiopia	Sudan	Ethiopia	Sudan	Ethiopia
Days to 50% flowering (rainy season)	82.83	81.03	4.40	3.90	73-90	75-92
Days to 50% flowering (postrainy season)	63.20	82.15	4.09	2.85	55-73	76-91
Plant height (cm) (rainy season)	283.08	298.33	45.30	31.06	210-370	230-375
Plant height (cm) (postrainy season)	169.58	201.83	32.26	33.93	120-235	140-275
Peduncle exertion (cm)	13.64	5.06	7.30	5.14	0-28	0-23
Grain size (mm)	3.41	3.45	0.29	0.35	2.50-3.50	3.0-4.0
100 Grain weight (g)	2.98	3.67	0.37	0.38	2.37-3.87	3.3-5.59

DISTRIBUTION

The most reliable source of information about the distribution of sorghum is the book *The cultivated races of sorghum* by Snowden (1936). His exhaustive study was published before the recent introduction of cultivars which have altered indigenous patterns of distribution. Snowden found the greatest diversity of caudatum to occur in the Sudan. The varietal diversity of caudatum was centered in the southern half of the country, suggesting that caudatum sorghums have been grown in Sudan for a relatively long time, and that they may have originated in this region (STEMLER, HARLAN and DE WET 1975a).

Zerazera sorghums belonging to the race *Caudatum* were reported by Snowden (1936) to be cultivated under the vernacular names *Zerzereih*, *Ziriziri*, and *Zerezira* in the Sudan. They were classified by Snowden under *Sorghum caudatum* Stapf var. *durum* Snowden. The landraces classified under the work group *Zerazera* by Murty *et al.*, (1967) were from the Sudan. *Caudatum* is a minor race in Ethiopia, and is mainly

grown in Western Ethiopia near the Sudan border (HARLAN and STEMLER 1976). Caudatums are not economically very important in Ethiopia, but are grown to some extent in lowland savanna regions, south and west of the Ethiopian plateau and in the hot and dry valleys that dissect the relatively cooler and wetter highlands. According to Stemler *et al.*, (1975b) caudatum growers in Ethiopia are savanna people who migrated into Ethiopia from the lowland savanna belt that stretches west of the Ethiopian highlands.

Several caudatum were collected in the Gambella area of Ethiopia bordering Sudan (PRASADA RAO and MENGESHA 1982). This area is ecologically different from the highlands of Ethiopia where durra sorghums are common. Caudatum growers in the Gambella area belong mainly to the 'Agnwak' tribe which is ethnically distant from the highland tribes of Ethiopia. Most of the sorghums cultivated in the Gambella area are zerazera. This suggests that zerazera sorghums were introduced from the Sudan to the Gambella area of Ethiopia, because of their suitability for cultivation with the residual moisture in the postrainy season after the rainy season floods recede.

Zerazera sorghums of Sudan and Ethiopia do not differ greatly in phenotype, except that Ethiopian zerazeras have slightly more open panicles, larger grains and spikelets with somewhat open glumes (Fig. 1 and 2). This is expected, since lax panicles and open glumes are advantageous in the Gambella area with high rainfall (1270 mm) and humidity. Zerazeras with these characters probably evolved in the Gambella area as a result of deliberate selection by farmers for genotypes with little mold infection at harvest. In spite of slight differences, zerazera sorghums from Sudan and Ethiopia are grouped together as subrace *Zerazera* under race *Caudatum*.

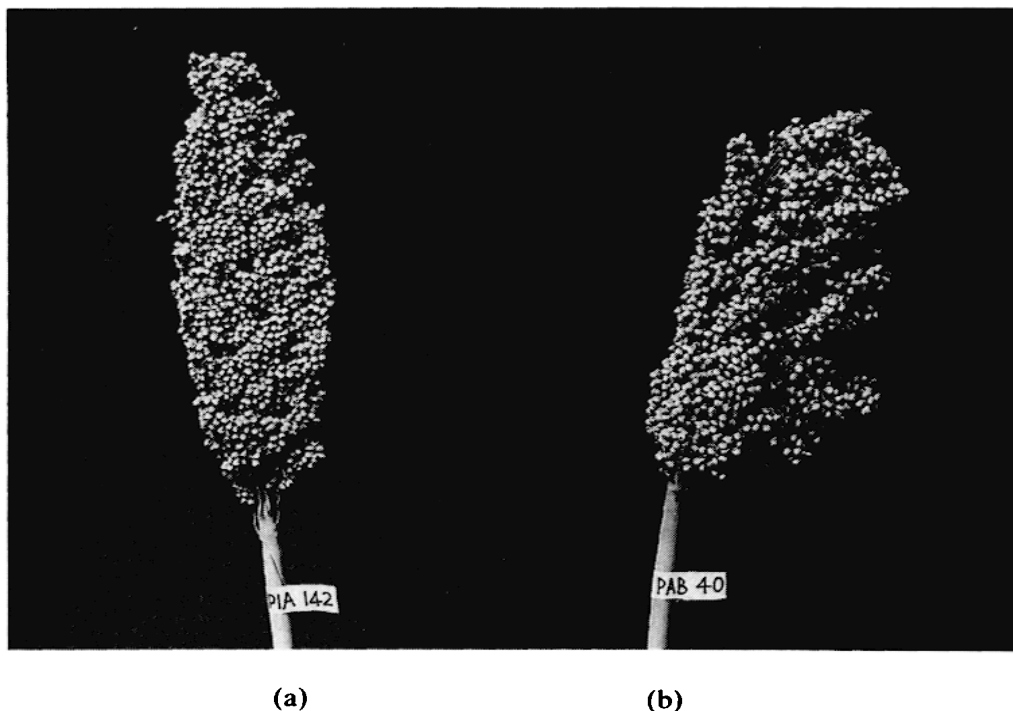


Fig. 1
Panicle shape of Zerazera sorghums
(a) PIA 142 Zerazera from Sudan
(b) PAB 40 Zerazera from Ethiopia

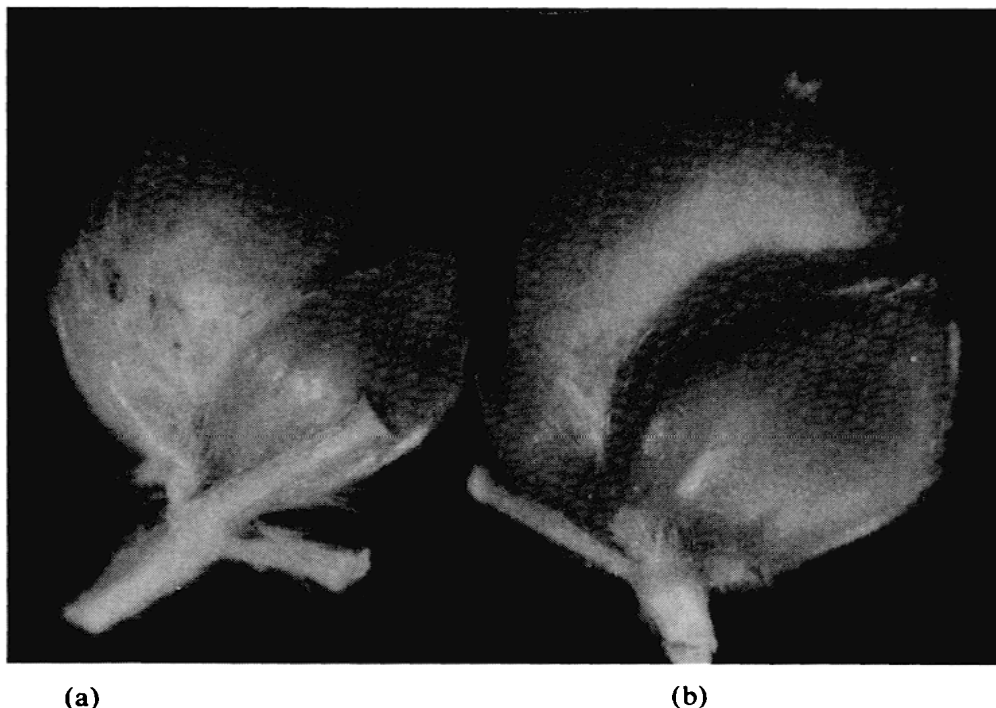


Fig. 2
Grain and glume shapes of Zerazera sorghums
(a) Zerazera from Sudan
(b) Zerazera from Ethiopia

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