

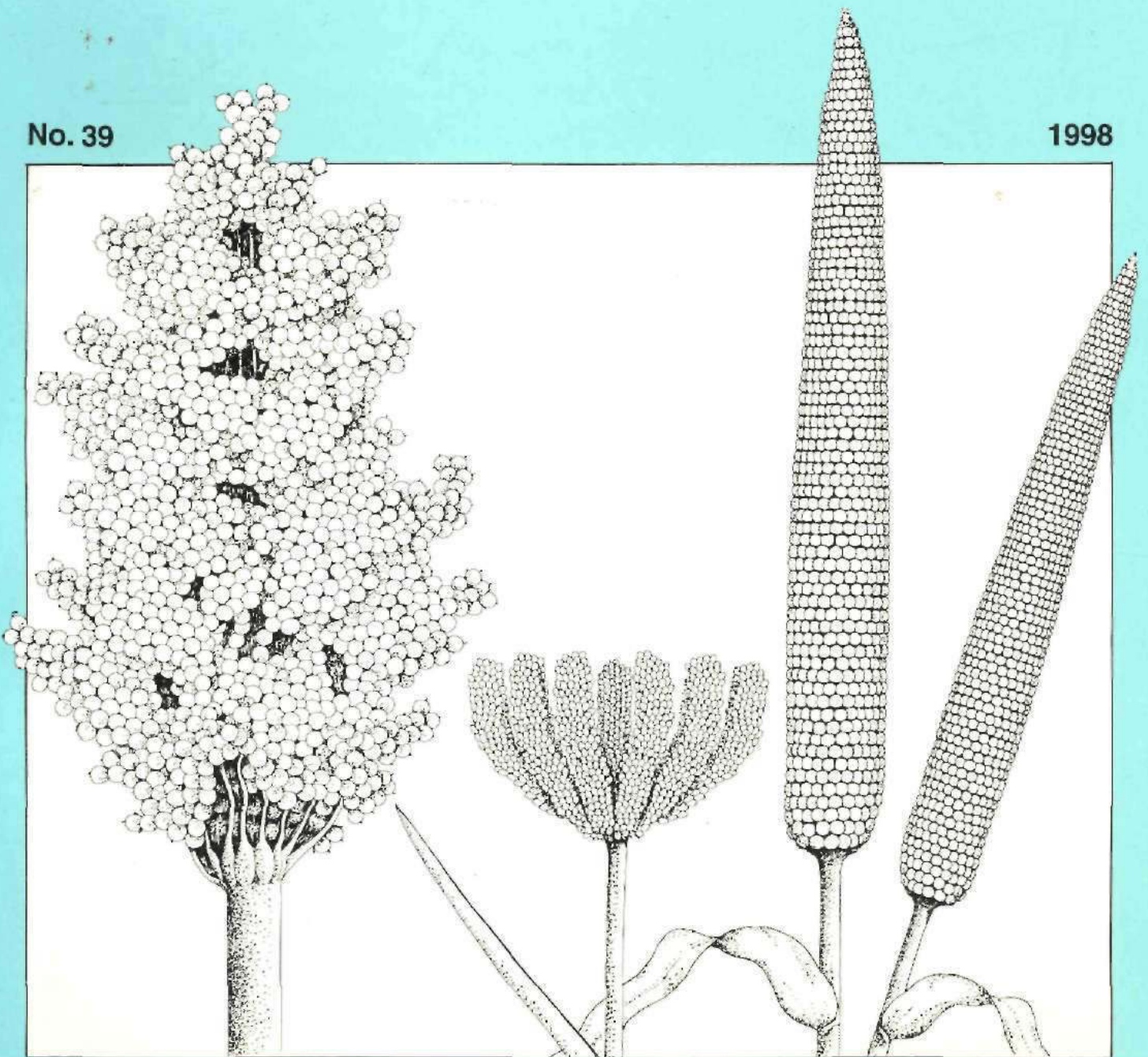


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of North America



ICRISAT

International Crops Research Institute
for the Semi-Arid Tropics

About SICNA

In 1947, sorghum breeders formed an informal working group to meet and review items of interest in sorghum breeding and genetics. This organization was named 'Sorghum Research Committee'. In the 1960s, with the advent of a number of severe disease and insect problems, special half-day sessions, particularly on diseases, became a part of the Sorghum Research Committee. In 1973, a concept was put forward that all sorghum workers, irrespective of discipline and employer, should meet twice a year to discuss mutual concerns with sorghum research and development. The Sorghum Improvement Conference of North America was that new organization. It is composed of eight disciplinary committees, dealing with genetics and breeding, pathology, entomology, chemistry and nutrition, physiology and agronomy, biotechnology, utilization and marketing, and agribusiness and commerce. SICNA meets formally once a year in conjunction with the National Grain Sorghum Producers Board. A general program of research, education, and developmental activities is prepared by the disciplinary committees. Funding is through membership participation and contributions from commercial donors. Essentially, SICNA represents the United States sorghum activities but accepts reports and encourages memberships from sorghum and millet researchers worldwide.

About ICRISAT

The semi-arid tropics (SAT) encompasses parts of 48 developing countries including most of India, parts of southeast Asia, a swathe across sub-Saharan Africa, much of southern and eastern Africa, and parts of Latin America. Many of these countries are among the poorest in the world. Approximately one-sixth of the world's population lives in the SAT, which is typified by unpredictable weather, limited and erratic rainfall, and nutrient-poor soils.

ICRISAT's mandate crops are sorghum, pearl millet, finger millet, chickpea, pigeonpea, and groundnut; these six crops are vital to life for the ever-increasing populations of the SAT. ICRISAT's mission is to conduct research that can lead to enhanced sustainable production of these crops and to improved management of the limited natural resources of the SAT. ICRISAT communicates information on technologies as they are developed through workshops, networks, training, library services, and publishing.

ICRISAT was established in 1972. It is one of 16 nonprofit, research and training centers funded through the Consultative Group on International Agricultural Research (CGIAR). The CGIAR is an informal association of approximately 50 public and private sector donors; it is co-sponsored by the Food and Agriculture Organization of the United Nations (FAO), the World Bank, the United Nations Development Programme (UNDP), and the United Nations Environment Programme (UNEP).

ISMN Scientific Editors 1998

J A Dahlberg

C T Hash

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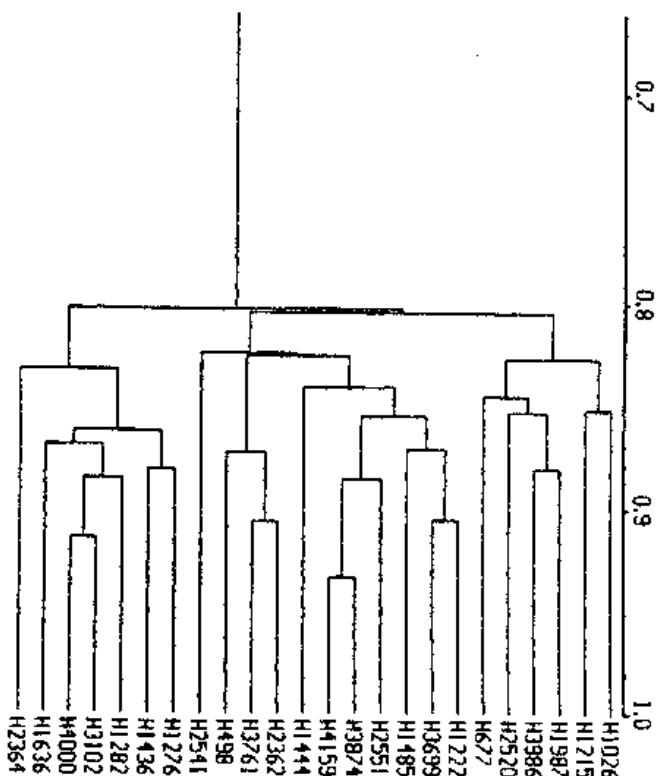


Figure 1. Association among sorghum breeding lines and varieties commonly used in South Africa revealed by cluster analysis performed on genetic similarity estimates (Nei and Li 1979) calculated from PCR data of 12 RAPD-primers corresponding to 246 bands.

similar origin or pedigree. These include PN3 from Malawi and Tenant White from Lesotho; Tophand (S4) and RTx430; RTx432 and MSU Sel. 549; Zululand-3 and SPV 475; Framida and the local collection from Zambia. Based on the results presented, RAPD-PCR, like RFLPs (Deu et al. 1994; Cui et al. 1995), can be considered an efficient tool for characterizing sorghum lines and germplasm at the DNA-level, enabling the establishment of heterotic groups in this important crop.

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Intensification of Tendency to Apomixis in Sorghum Autotetraploids

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A connection between polyploidy and apomixis is universally recognized but literature data are contradictory on artificial polyploidization influences upon manifestation of apomixis in cultivars. In sorghum (*Sorghum bicolor* (L.) Moench), polyembryonic seeds were found with an equal or lower frequency in autotetraploid analogues of three varieties compared with diploid analogues (Tsvetova and Ishin 1996). As polyembryony is a well-known marker of apomixis, these data suggests that in autotetraploid sorghums there is a tendency for apomixis to be lower than in diploids. An embryological study was undertaken to verify these findings.

Tetraploids of genotype k-3366/2 (*Sorghum nigricans* (Ruiz et Pavon) Snowd.) and a partially sterile line AS-1 (Elkonin et al. 1995) have been induced through treatment of shoot meristems with 0.2% aqueous colchicine for 24 h. In genotype Geltosernoye 10 (*S. subglabrescens* Schweinf. et Aschers.), tetraploids were induced by applications of nitrous oxide upon dividing zygotes (7 atms, 24 ins). Ovaries were fixed in an ethanol-acetic acid fixative (3:1) and stained with acetocarmine. The ovules were then dissected from the ovaries and embryo sacs (ESs) were obtained. For this investigation mature ESs were used.

Most of the tetraploid ESs had the same structure as found in diploid plants, but they were enlarged in comparison to those found in haploid plants. In some of the ES structures, anomalies typical for tetraploids were found: two nucleoli in egg cells, synergids or polar nuclei. In some cases, diploid ESs had one or three polar nuclei.

In the diploid and the tetraploid analogues of k-3366/2 some ovules contained additional ESs. The ESs from multiple ES arising from the same ovule had either approximately equal or different sizes. Sometimes one of the members of such a couple had symptoms of degeneration. In diploids, the percentage of such ovules was 4.3% and in tetraploids it was 3.0% (significant difference at 0.05% probability level).

In 1.24% of the tetraploid k-3366/2 ESs studied, synergids resembling egg-cells were found, whereas in diploid plants this anomaly was not found. In the tetraploid plants of Geltosernoye 10 about 5% of the ovules contained additional ESs versus 0.5% for the diploid plants. ESs of diploid plants were of equal size and situated near each other.

In five out of ten tetraploid Geltosernoye 10 plants, some ovules had considerably enlarged cells with one or two nuclei alongside the normal ES. These enlarged cells were located either near the antipodal region or near the micropolar end of the ES. They always maintained contact with the ES. The number and the size of such cells varied in different ovules.

Formation of additional structures was also observed in the ovules of almost all plants studied in the line AS-1 (Elkonin et al. 1995). Besides the additional ESs and enlarged cells with 1-2 nuclei, giant cells containing up to 10 nuclei (cenocytes) have been found in ovules of this line. In the material reported here, 3.4% of ovules in the diploid plants contained enlarged cells and 1.4% had cenocytic structures. In tetraploid plants, 7.5% of the ovules contained enlarged cells and 1.6% had cenocytic structures.

The additional enlarged cells or ESs associated with an individual meiotic ES may be interpreted as a manifestation of apospory, i.e., the development of ESs from somatic cells. In Geltosernoye 10 and AS-1, artificial polyploidization essentially strengthened a tendency to aposporous structure development.

In tetraploid analogues of k-3366/2, such structures have not been found. However, egg-cell-like synergids have been discovered that are connected with polyembryony and apomixis (Maheshwari 1950), and their increased frequency in ESs of the tetraploids also shows an intensification of tendency to apomixis.

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Nuclear Male-fertile Revertants Derived from a cms Sorghum Plant with Developmentally Regulated Levels of Male Fertility

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Male-fertile revertants are important for investigating structures and functions of the genetic systems controlling cytoplasmic male sterility (cms) in sorghum (*Sorghum bicolor* (L.) Moench).

Among the F₂ segregating population of the A₁ Saratovskoe-3/KVV-124 hybrid, we isolated a male-sterile plant. The panicle on the main tiller of this plant was completely sterile. The immature panicle from one of its later tillers was used to obtain embryogenic callus cultures, while the donor plant itself was transferred from the field to the greenhouse. All 16 plants regenerated from callus cultures were also male sterile, thus confirming the male-sterile nature of the donor plant.