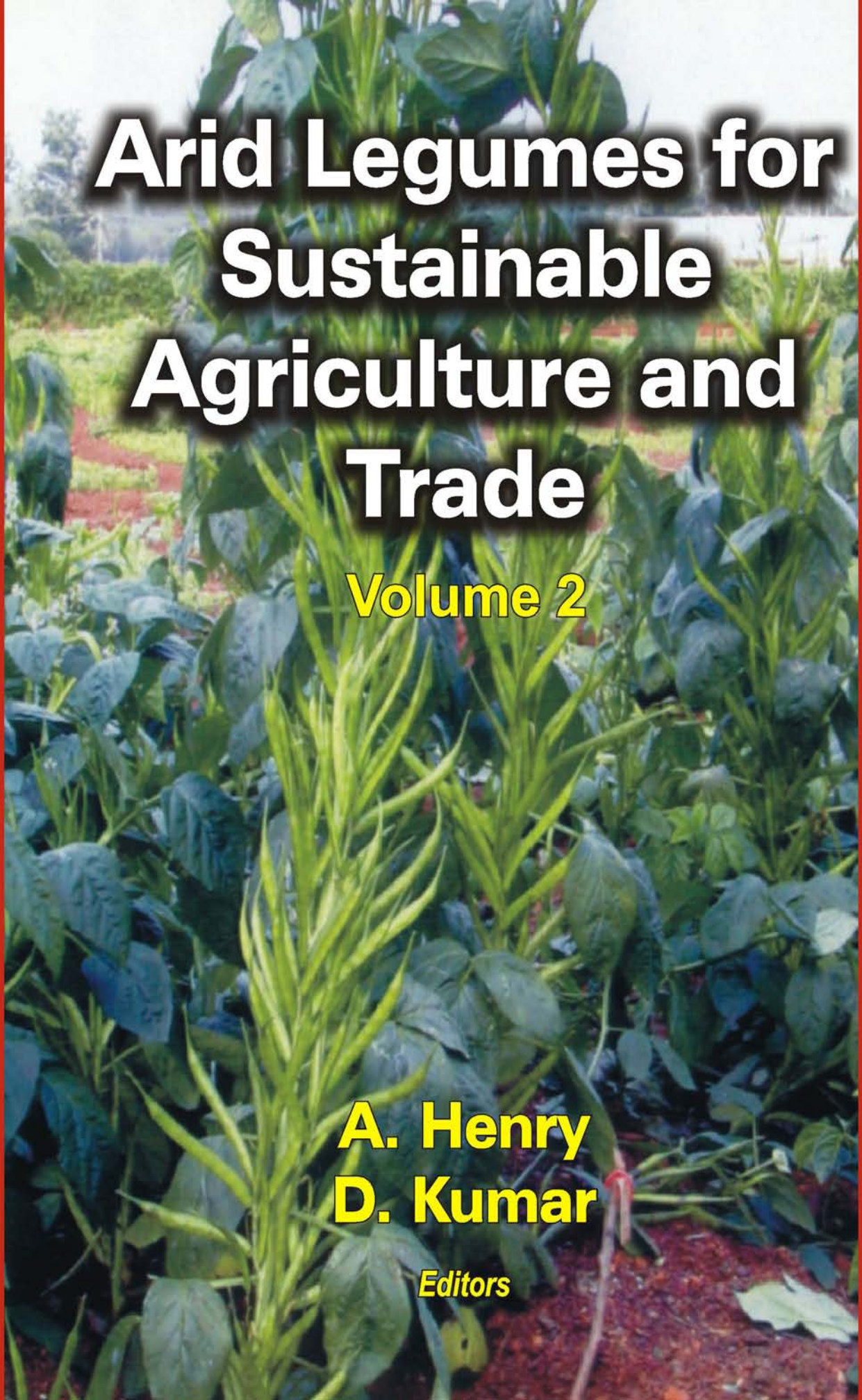

Arid Legumes for Sustainable Agriculture and Trade

Volume 2

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Editors

SCIENTIFIC PUBLISHERS

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Identification of plant architectural components and ideotypes in cowpea

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Abstract

Forty-seven cowpea genotypes including germplasm accessions and mutants with early or medium maturity were examined for major plant architectural components like growth habit, stem characteristics, branching pattern, leaf size and shape, pod characteristics and plant canopy. Considerable variability was observed in the genotypes with respect to their growth habit and morphological features. Thirteen genotypes with upright growth habit, two with dwarf compact plant type and one with pods above the canopy were identified. In addition, six recombinants with diverse plant architecture were evaluated for agronomic attributes. Two recombinants with dwarf and medium stature and high yield potential and other two with large seed size (26-29 g/100 seed) were identified. The high yielding dwarf recombinant is envisaged as the most desirable ideotype. The recombinants with large seed size can be used to develop market ideotypes. The identified genotypes with desirable attributes can be utilized for developing suitable ideotypes for different climatic zones.

Key words: cowpea, *Vigna unguiculata,* plant architecture, ideotype, plant type

Introduction

Plant architecture plays an important role in breeding for higher yield and adaptation of grain legume crops (1). Cowpea (*Vigna unguiculata*), one of the important food legume crops, exhibits wide range of genetic diversity for morphological traits such as plant height, growth habit, leaf shape – size and texture, pod and seed characteristics (2). Additional variability can be created through induced mutation and hybridization. Identification of diverse plant types or architectural components can help develop varieties that can contribute higher seed yield or convenience to cultural operations. The architectural components encompass various features like shape, size, geometry and external structure of the plant, branch characteristics, number and length of internodes, leaf structure and its orientation, pods and grain characteristics. Singh and Sharma (3) while emphasizing the need of restructuring cowpea for higher yield envisaged future cowpea varieties to combine high yield with upright growth habit, bushy plant type, determinate flowering, early or medium maturity and long peduncle keeping the pods above canopy. Evolving varieties with large seed size will be important with market point of view. With these objectives, the cowpea improvement programme through mutational and conventional breeding approaches was initiated at Bhabha Atomic Research Centre, Trombay, Mumbai; and a number of promising selections, mutants (4, 5) and recombinants were developed. In the present study, cowpea germplasm accessions, mutants and recombinants were investigated for their architectural characteristics with a view to identifying suitable ideotypes.

Materials and methods

The seeds of cowpea genotypes used in the study were obtained from Indian Agricultural Research Institute, New Delhi; and International Institute of Tropical Agriculture, Nigeria. Preliminary field studies on growth habit, leaf and pod characteristics, seed yield and maturity period were carried out and the promising ones were selected for further studies. Three genotypes viz. V-130, V-240 and EC394736 were subjected to induced mutagenesis with gamma rays (200 -250 Gy), and mutants isolated and stabilized. Forty-seven genotypes including mutants with early and medium maturity were grown at Trombay during

late kharif (mid- September to mid-December, 2002), and qualitative and quantitative data on major plant architectural components such as growth habit, stem characteristics, branching pattern, leaf size and shape, pod characteristics and plant canopy were recorded. Leaf area was measured using image analysis software Biovis Image Plus (Expert Vision Labs Pvt. Ltd. Mumbai). In addition, recombinants for architecturally important features were selected from the F_2 and F_3 generations of the two crosses viz., EC 394763 x TC 201 and EC 394735 x 13-1 (mutant of V-240), and studied for their breeding behaviour in the F_4 and F_5 generations during the years 2003 and 2004. Six recombinants with architecturally distinct features were evaluated in the F_6 generation for their agronomic attributes and yield during late rabi/ early summer (January – mid-April, 2005), along with TC-201, a determinate plant mutant as the check variety. Ancillary data of five plants of each recombinant were recorded and analysed using 'Plant breeding and Genetics package of Windostat version 7.1' (Indostat Services, Hyderabad).

Results and discussion

The 47 genotypes grown during late kharif 2002 exhibited considerable variability with respect to their maturity period (62 to 90 days) and morphological features, and could be classified as shown in Table 1a.

Table 1a. Cowpea genotypes classified on the basis of their growth habit and maturity

Maturity group	Growth habit		
	Indeterminate	Semi determinate	Determinate
Early (<75 days)	EC394724, EC394725, EC394821, TCM138-4, V-585	EC394736, EC394763, EC394740, TCM148-1, TCM10-2	EC394733, EC394745, EC394805, EC394814, EC394823, EC394835, EC394790, TC-201 (mutant of EC 394736)
Medium (75 to 90 days)	EC394695, EC394743, EC394753, EC394760, EC394767, EC394768, EC394773, V240, TCM121-8, TCM76-2, TCM21-1, TCM13-3, TCM121-1, TCM55-5, TCM119-9, C504-1-1, TCM123-1, TCM113-1	EC364691, TCM38-1, V130, TCM134-2, TCM42-1, C503, C352	TCM77-4, TCM138-9, C16, C440

Table 1b. Stem characteristics and branching pattern of cowpea genotypes

Parameter	Feature	Genotype
Stem characte-ristics	Serpentine	EC394696, EC394763, EC394736, EC394768, TCM76-2, TCM121-1, C503, C504-1-1, EC394805, EC394745, TCM77-4, C16, V130, TCM42-1, EC394695, EC394790
Branching pattern	First two branches opposite	EC394773, TCM 21-1, C503, TCM 55-5,TCM 119-9, TCM123-1, TCM 113-1, EC394835, TCM138-9, C-16, TCM38-1, TCM134-2, TCM42-1
	First two branches horizontal	EC394724, EC394821, V585, C16, TCM42-1, EC394753, EC394773, C503, C504-1-1

Growth habit: Of the 47 genotypes, 23 showed indeterminate, 12 semi-determinate and remaining 12 determinate growth habits.

Plant height & stem characteristics: The maximum plant height (135.4 cm) was observed in V240 while the minimum plant height (19cm) was observed in C440. Twenty-seven genotypes had plant height less than 50 cm. While majority of genotypes had weak stems with trailing growth habit, 13 genotypes (EC 394724, EC 394725, EC 394763, TC 201, EC 394805, EC 394814, EC 394823, EC 394835, TCM77-4, C-16, C-352, C 440, C 503) had erect, and 8 (EC 394691, EC 394743, EC 394695, EC 394753, EC 394760, EC 394767, EC 394768, EC 394773) semi-erect stems. The stems in eleven genotypes (EC 394724, EC394821, V-585, EC394740, TCM148-1, EC394805, EC394814, EC 394745, EC394691, TCM 38-1 and EC394760) were ridged, while in others they were cylindrical. Sixteen genotypes had serpentine stem (Table 1b), in contrast to the straight stem of the remaining genotypes. The number of nodes on the stem ranged from 6.8 (C440) to 16.4 (EC 394760) with mean value of 11.6. The inter-nodal distance was lowest in the genotype C440 (0.9cm) followed by mutant TCM77-4 (1.2 cm), and highest (6.8 cm) in V240 with mean value of 2.7cm.

Branching Pattern: The variability in branching pattern included first two branches growing opposite to each other or alternate.