

Classification of Varieties and Types of Castor (*Ricinus communis* L.)

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Introduction: Castor varieties were classified based on eco-geographical grouping and on certain morphological characters by previous workers. Eventhough none of the systems of classification could be completed in castor, in view of the free inter-crossability of the different varieties and forms of divergent origin, classifying the available material with a bias for breeding work, based on certain chosen morphological and economic attributes of known heritability seems to be purposeful. This is justifiable, as the large number of varieties collected from all over the world serve mainly as the fundamental material for the evolution of high yielding strains. Further the classification helps to take stock of the variability available in the germplasm with the purpose of utilising them in the breeding programme, while simultaneously trying to strengthen the gene bank with varieties of new combinations of characters from other sources. With this objective, an attempt to classify the varieties available in the germplasm at the Castor Research Station, Salem has been made and the results are presented.

Materials and Methods: The study on classification was made with 154 varieties of castor (maintained as inbred lines) of which 68 were indigenous and 86 were exotic varieties, chiefly from U.S.A., South Africa, Egypt, U.S.S.R., Philippines, Israel, Ceylon, Italy and France. These varieties were raised during the monsoon seasons of 1965-66 to 1967-68 under rainfed condition, adopting a uniform spacing of 90 cm x 90 cm. The data on all the morphological and economic attributes were recorded in twenty plants in each of the varieties and the following nine characters were utilized in the classification based on their importance in breeding work; (1) duration, (2) dehiscence of capsules, (3) colour of stem, (4) bloom nature, (5) size of seeds, (6) surface of epicarp of the capsule, (7) length of main raceme, (8) the proportion of pistillate and staminate region of the inflorescence and (9) stature of the plant.

Results: The key for the identification of castor varieties prepared based on the chosen nine characters is presented below :

1. Crop Specialist (Oilseeds), 5. Research Scholar, 6. Assistant in Oilseeds, Tamil Nadu Agricultural University, Coimbatore. 2. Crop Specialist (Paddy), 3. Rice Breeder, Regional Agricultural Research Station, Aduthurai. 7. Post Graduate Student, Agricultural College, Madurai, and 4. Assistant Crop Specialist (Oilseeds), Kovilpatti.

I. *Short duration varieties*

- A. Dehiscent capsules B. Green stem
 CCC. Double bloom D. Very small seeds ... [1] R.c. 1203
 (Philippines)
 BB. Rose stem CC. Single bloom ...
 DDD. Medium seeds ... [2] R.c. 1170/1
 (South Africa)
- AA. Non-dehiscent capsules B. Green stem
 C. No bloom D. Very small seeds ... [3] R.c. 1097
 (Baker-I-U.S.A.)
 DDD. Medium seeds ... [4] R.c. 1297 (U.S.A.)
 CC. Single bloom D. Very small seeds ... [5] R.c. 1098 (U.S.A.)
 DD. Small seeds ... [6] R.c. 1130
 (New Delhi)
 DDD. Medium seeds ... [7] R.c. 1229 (U.S.A.)
- BB. Rose stem CC. Single bloom
 D. Very small seeds ... [8] R.c. 1125
 (Senegal)
 DD. Small seeds ... [9] R.c. 1302 (Culture
 from TMV 1
 R.c. 1098)
 DDD. Medium seeds EE. Warty capsules ... [10] R.c. 1077
 (South Africa)
 EEE. Spiny capsules ... [11] R.c. 1193/1
 (France)
 DDDD. Large seeds ... [12] R.c. 1225 (U.S.A.)
 CCC. Double bloom ... [13] R.c. 1179/2
 (South Africa)
 BBB. Mahogany stem C. No Bloom
 DD. Small seeds ... [14] R.c. 1199
 (Kanpur)
 DDD. Medium seeds ... [15] R.c. 1092 (Italy)
 DDDD. Large seeds E. Smooth capsules ... [16] R.c. 1168/2
 (South Africa)

II. *Medium duration varieties*

- A. Dehiscent capsules B. Green stem CC. Single
 bloom DDD. Medium seeds ... [1] R.c. 1242 (U.S.A.)
 CCC. Double bloom DD. Small seeds ... [2] R.c. 1163 (Ceylon)
 CCCC. Triple bloom DDD. Medium seeds ... [3] R.c. 902 (Ghodia
 Manghyr)
 BBBB. Purple stem C. No bloom D. Very
 small seeds EEE. Spiny capsules ... [4] R.c. 1362
 (Philippines)

AA. Non-detiscent capsules	
B. Green stem C. No bloom	
DDD. Medium seeds	... [5] R.c. 1220 (U.S.A.)
DDDD. Large seeds	... [6] R.c. 1241 (U.S.A.)
CC. Single bloom EE. Warty capsules	... [7] R.c. 552/2 (Nagpur)
EEE. Spiny capsules GG. Intermediate inflorescence	HH. Medium stature ... [8] R.c. 906 (Egypt)
HHH. Tall stature	... [9] R.c. 873/1 (Egypt)
GGG. Pistillate inflorescence	... [10] R.c. 1226 (U.S.A.)
CCC. Double bloom DD. Small seeds	... [11] R.c. 837 (Kanpur)
DDD. Medium seeds F. Short raceme	
H. Small stature	... [12] R.c. 1092 (U.S.A.)
HH. Medium stature	... [13] R.c. 856 (Averli-Kathiawar)
FF. Medium raceme H. Small stature	... [14] R.c. 1223 (U.S.A.)
HHH. Tall stature	... [15] R.c. 833 (Egypt)
GGG. Pistillate inflorescence	... [16] R.c. 834 (Rajampet big)
FFF. Long raceme	... [17] R.c. 820 (U.S.S.R.)
BB. Rose stem CC. Single bloom	
EE. Warty capsule	... [18] R.c. 651/1 (Kanpur)
F. Short raceme	... [19] R.c. 921 (Egypt)
FF. Medium raceme	... [20] R.c. 881 (Rajampet)
FFF. Long raceme	... [21] TMV 1 (Tindivanam)
DDD. Medium seed EEE. Spiny capsule	
F. Short raceme GG. Intermediate inflorescence	... [22] R.c. 869/1 (Egypt)
GGG. Pistillate inflorescence	
H. Short stature	... [23] R.c. 914 (Egypt)
FF. Medium raceme GG. Intermediate inflorescence	... [24] R.c. 835 (Kanpur)
GGG. Pistillate inflorescence	
HH. Medium stature	... [25] R.c. 1188 (Culture from TMV 1 × R.c. 1094)
HHH. Tall stature	... [26] R.c. 961 (Modalai-patti-NamakkaI)

- FFF. Long raceme ... [27] R.c. 1168/3
(Kanowild
S. Africa)
- CCC. Double bloom DD. Small seeds
F. Short raceme GG. Intermediate
inflorescence ... [28] R.c. 842
(Cuddappah)
- GGG. Pistillate inflorescence ... [29] R.c. 1141 (Ceylon)
- FFF. Long raceme ... [30] R.c. 822
(U.S.S.R.)
- DDD. Medium seeds F. Short raceme
GG. Intermediate inflorescence ... [31] R.c. 816
(Kumbakonam)
- GGG. Pistillate inflorescence ... [32] R.c. 903/2
(Ghodia-Monghyr)
- FF. Medium raceme HH. Medium stature ... [33] R.c. 901 (Kanpur)
- HHH. Tall stature ... [34] R.c. 882
(Rajampet)
- DDDD. Large seeds ... [35] R.c. 879/1
(Rajampet)
- CCCC. Triple bloom EE. Warty capsules ... [36] R.c. 831/1 (Egypt)
- DD. Small seeds F. Short raceme
G. Staminate inflorescence ... [37] R.c. 1291
(Jabalpur)
- GG. Intermediate inflorescence ... [38] R.c. 865
(Namakkal)
- GGG. Pistillate inflorescence .. [39] R.c. 884
(Namakkal)
- FF. Medium raceme .. [40] R.c. 880
(Rajampet)
- DDD. Medium seeds F. Short raceme ... [41] R.c. 888
(Nagpur small)
- FF. Medium raceme GG. Intermediate
Inflorescence ... [42] R.c. 826
(U.S.S.R.)
- GGG. Pistillate inflorescence ... [43] R.c. 719/2 (Egypt)
- DDDD. Large seeds ... [44] R.c. 719/1 (Egypt)
- BBB. Mahogany C. No bloom
DD. Small seeds EEE. Spiny capsules
HH. Medium stature ... [45] R.c. 871 (Egypt)
- HHH. Tall stature ... [46] R.c. 1136
(New Delhi)

DDDD. Medium seeds	EE. Warty capsules	
HH. Medium stature		... [47] R.c. 1177/1 (South Africa)
HHH. Tall stature		... [48] R.c. 1246 (U.S.A.)
EEE. Spiny capsule	F. Short raceme	... [49] R.c. 1167 (Israel)
FF. Medium raceme	GG. Intermediate inflorescence	... [50] R.c. 1175/2 (South Africa)
GGG. Pistillate inflorescence		... [51] R.c. 872 (Egypt)
DDDD. Large seeds		... [52] R.c. 1179/1 (South Africa)
CC. Single bloom	DD. Small seeds	
EEE. Spiny capsules		... (53) R.c. 852 (Bhatagiri)

III. *Long duration varieties*

A. Dehiscent capsules	B. Green stem	
C. No bloom	DD. Small seeds	... [1] R.c. 1221 (U.S.A.)
DDD. Medium seeds		... [2] R.c. 1118 (Senegal)
DDDD. Large seeds		... [3] R.c. 1243 (U.S.A.)
DDDDD. Very large seeds		
HH. Medium stature		... [4] R.c. 1071 (Ornamental)
HHH. Tall stature		... [5] Co.1 (Coimbatore)
CCC. Double bloom	DDD. Medium seeds	
HH. Medium stature		... [6] R.c. 1245 (U.S.A.)
HHH. Tall stature		... [7] R.c. 892 (Nandyal)
DDDD. Large seeds		... [8] R.c. 1240 (U.S.A.)
CCCC. Triple bloom	DDD. Medium seeds	
GGG. Pistillate inflorescence		... [9] R.c. 1196 (Kanpur)
DDDD. Large seeds		
GG. Intermediate inflorescence		... [10] TMV 3 (Tindivanam)
BB. Rose stem	CCCC. Triple bloom	... [11] R.c. 1068 ((Orna- mental culture)
BBB. Mahogany stem	C. No bloom	
DD. Small seeds		... [12] R.c. 1164 (Ceylon)
DDD. Medium seeds		... [13] R.c. 1069 (Ornamental)
DDDD. Large seeds		... [14] R.c. 1066 (Ornamental)

AA. Non-dehiscent capsules B. Green stem	
C. No bloom DDD. Medium seeds	
F. Short raceme GG. Intermediate inflorescence	... [15] R.c. 1108 (Senegal)
GGG. Pistillate inflorescence	... [16] R.c. 1114 (Recin-18-Senegal)
FF. Medium raceme	... [17] R.c. 1110 (Recin-6-Senegal)
DDDD. Large seeds F. Short raceme	
HH. Medium stature	... [18] R.c. 1117 (Recin-31-Senegal)
FF. Medium raceme G. Staminate inflorescence	... [19] R.c. 1111 (Recin-5-Senegal)
GG. Intermediate inflorescence	... [20] R.c. 1115 (Recin-20-Senegal)
FFF. Long raceme	... [21] R.c. 1072 (Ornamental culture)
HHH. Tall stature	... [22] R.c. 1230 (U.S.A.)
DDDDD. Very large seeds	... [23] R.c. 1112 (Senegal)
CC. Single bloom DDD. Medium seeds	
F. Short raceme	... [24] R.c. 1234 (U.S.A.)
FF. Medium raceme	... [25] R.c. 1224 (Nebraska-U.S.A.)
DDDD. Large seeds	... [26] R.c. 1233 (Nebraska-U.S.A.)
CCC. Double bloom DDD. Medium seeds	
F. Short raceme	... [27] R.c. 1217 (West Bengal)
FFF. Long raceme HH. Medium stature	... [28] R.c. 1198 (Kanpur)
HHH. Tall stature	... [29] R.c. 1073 (Ornamental)
CCCC. Triple bloom DDD. Medium seeds	
HH. Medium stature	... [30] R.c. 1200 (Kanpur)
DDDD. Large seeds FF. Medium raceme	... [31] R.c. 1101 (Nagpur)
HH. Medium stature FFF. Long raceme	... [32] R.c. 913 (Namakkal)
HH. Tall stature	...
BB. Rose stem CC. Single bloom	
DD. Small seeds HH. Medium stature	... [33] R.c. 1119 (Senegal)
HHH. Tall stature	... [34] R.c. 1113 (Senegal)

DDD. Medium seeds	F. Short raceme	... [35] R.c. 1205 (Phillippines)
FF. Medium raceme		... [36] R.c. 605 (Tiruchi)
FFF. Long raceme		... [37] R.c.1286 (Mysore)
DDDD. Large seeds		... [38] R.c. 1138 (New Delhi)
CCC. Double bloom	DD. Small seeds	
FF. Medium raceme		... [39] R.c.1285 (Mysore)
G. Staminate inflorescence		
GG. Intermediate inflorescence		... [40] R.c.895 (Nandyal)
FFF. Long raceme		... [41] R.c.1287 (Mysore)
DDD. Medium seeds	F. Short raceme	... [42] R.c. 847 (Vinukonda)
FF. Medium raceme	GG. Intermediate inflorescence	... [43] R.c. 843 (Cuddappah)
GGG. Pistillate inflorescence		... [44] R.c.993 (Ariyalur)
DDDD. Large seeds		... [45] TMV2 (Tindivanam)
CCCC. Triple bloom	DD. Small seeds	
F. Short raceme		... [46] R.c. 1218 (Jabalpur)
FF. Medium raceme		... [47] R.c. 817 (Kovilpatti)
DDD. Medium seeds	F. Short raceme	
GG. Intermediate inflorescence		... [48] R.c. 962 (Salem small)
FF. Medium raceme		
G. Staminate inflorescence		... [49] R.c.1284 (Mysore)
BBB. Mahogany stem	C. No bloom	
DDDD. Large seeds	DEE. Spiny capsule	
F. Short raceme	HH. Medium stature	... [50] R.c. 1116 (Senegal)
HHH. Tall stature		... [51] R.c. 1239 (U.S.A.)

The entire collection of 154 varieties could be distinguished into 120 types, 16 under short duration, 53 under medium duration and 51 under long duration.

The varieties were grouped into three categories based on duration and classified as short when 150 days and below, medium when between 151 and 195 days and long when 196 days and above. Depending upon the dehiscent or non-dehiscent nature of capsule, the varieties were further divided. While

attempting to group them according to stem colour, four distinct colour grades, green, rose, mahogany and purple were recognised. The varieties were further grouped based on the nature of bloom as no bloom, single bloom, double bloom and triple bloom. In the varieties, the size of seed could be identified as very small, small, medium, large and very large. Depending upon the surface of the epicarp of the capsules, they were divided as smooth, warty and spiny types. Considering the importance of the length of racemes, the varieties were classified into short, medium and long racemed types. Based on the nature of the inflorescence, three groups such as staminate, intermediate and pistillate were identified. The stature of the plants, short, medium and tall, was utilized as one of the bases for classification.

Discussion: The Linnaean species *Ricinus communis* was first classified on eco-geographical basis by Popova (1930) into sub-species *Persicus*, *Zanzibarinus*, *Sanguirzus*, *Africanus* and *Mexicanus*, while Hilterbrandt (1935) grouped the last three sub-species into one group 'Indo-African' and divided the sub-species *Persicus* into four types, *Chinensis* into three types and *Indo-African* into seven types. Zainulabudin *et al.* (1963) classified the varietal collections based on morphological characters such as stem colour, bloom nature, height of plant, nature of inflorescence, habit of growth, capsule surface and seed size. Bailey (1963) divided the castor varieties based on markings on the seed coat, shape of cotyledon, glands on the petiole and size of seed.

In India, no comprehensive classification of castor varieties seems to have been attempted so far and hence the large number of varieties available at Salem were classified based on certain chosen morphological and economic attributes, with a bias for breeding work. The importance of the characters chosen, their mode of inheritance and the standards for description were discussed in detail elsewhere (Varisai Muhammad *et al.* 1971). The four qualitative and five quantitative characters utilized in the present classification are heritable.

The duration of castor plant is of primary importance to the breeder, since the fundamental material he wants to deal with depends upon the duration of the improved strain that is required to be evolved. The requirement may be a short duration strain that will come to harvest along with other short duration crops in the mixed cropping programme like groundnut, *jowar* and *bajra* or a medium or long duration strain for mixed or border cropping with cotton, turmeric, chillies and sugarcane. In the germplasm collection, the indigenous varieties of castor were all medium to long in duration, while only among the improved African and American varieties, there were short duration types. This fact may be due to the differential origin of the short duration types on the one hand and the medium and long duration types on the other in the two different eco-geographical regions of Africa and India respectively.