G. plantii—Boat-shaped pollen grains, equatorial diameter in polar view 30 μm, length of sulci 30 μm; breadth of sulci at the center 10 μm, monosulcate, sulcus distally placed, in one case aperture wide open to form a hollow (figure 5). Sexine striatoreticulate with fine reticulation, heterobrochate, diameter of the lumina varies from 0.3–0.8 μm.

G. Masterpiece—Grains linear, boat-shaped, equatorial diameter in polar view 40 μm, length of sulci 35 μm, monosulcate, sulcus distally placed, sexine striatoreticulate, heterobrochate, diameter of the lumina varies from 0.2–0.4 μm.

G. Shrimati-Bhima—Grains boat-shaped, equatorial diameter in polar view 35 μm, length of sulci 32 μm; breadth of sulci (at the centre) 3 μm, monosulcate, sulcus distally placed, sulcus somewhat constricted at the middle, in one case sulcus linear in shape (figure 17), sexine striatoreticulate, heterobrochate, diameter of the lumina varies from 0.2–0.6 μm.

G. rothschildiana—Pollen grains boat-shaped, equatorial diameter in polar view 35 μm, length of sulci 30 μm, sulcus distally placed, linear in shape, sexine finely reticulate, in some cases it appears to be striatoreticulate, heterobrochate, diameter of the lumina varies from 0.3–0.5 μm.

To summarize, the pollen grains in Gloriosa are monocolpate, boat-shaped and linear with above contrasting features.

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GRAIN GRADE INDEX—a new method for realizing potential yields in rice

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In the plant improvement programme, selection of plants based on short stature (dwarfism) and good panicle size contributed to increased yields in the past by avoiding lodging and increasing harvest index. Considering the potentials of increasing the yields, several approaches are pursued to identify plants with greater number of filled grain. The present study indicates the need to develop screening techniques to identify plants with potential grains to increase productivity.

Since the yield is the ultimate net product consisting of spikelet number and weight as influenced by kernel growth and development, it is considered desirable to screen varieties based on the kernel filling. The specific gravity of a grain determines the degree to which the cavity of the hull is filled as a result of kernel development and is taken as a convenient scale to express the degree of spikelet filling. Different specific gravity solutions are prepared by mixing common salt in water at different proportions and the respective level of specific gravity is tested by hydrometer. In this method, the grains are immersed in each specific gravity solution separately and the floated ones (chaff and partially filled grain) are removed, while the immersed grain of the first solution are dropped into the next grade and so on. With this method, grains of differential filling can be sorted out easily. On milling, the differences in kernel size are distinctly differentiated.

Based on the kernel size and the proportion of number, 1.18 specific gravity was considered as the best media for screening of grain with fully filled kernels. With an increase in the specific gravity, however, the filled spikelets decreased, while the 1000 grain weight (grain size) increased. Thus different grades of grain were characterized as (i) average (ii) good and (iii) very good in a panicle based on the degree of spikelet filling (figure 1). In a variety like Mahsuri (figure 1), when the distribution of filled spikelets was characterized, the proportion of a very good grain was found to be 59 %, (at 1.18 specific gravity) while in Jaya and Prakash, it was 55 % and 47 % respectively indicating the scope for improvement in grain filling further by 41, 45 and 53 % respectively. Varietal differences in potential grain
filling however indicate the type of variation existing, and the amount of scope for improvement in attaining potential yields.

The term 'grain grade index' indicates the proportion of fully filled spikelets recovered at 1.18 specific gravity to a total number of spikelets formed. It is suggested that this index is useful as a screening tool in varietal improvement programme irrespective of the stresses for identifying high yield potential plants.

22 July 1985; Revised 26 December 1985

1. Matsushima, S., Crop Science in Rice, 1967, 12, 162.

ULTRA-EARLY SEMIDWARF VARIANT IN PIGEONPEA

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During kharif 1983, a semidwarf plant of pigeonpea (Cajanus cajan (L) Millsp) was located which flowered very early as compared with the parental population. The parental bulk population, '74068 NDT 1', was obtained through the courtesy of ICRISAT, Hyderabad. In the following season, kharif 1984, progeny from this plant (variant line) was space planted, 60 × 20 cm, in a four-row plot of 5 m length. For comparison, the earliest maturing pigeonpea lines from extra early maturing group, viz Pant A3, UPAS-
Table 1 Observations recorded on various characteristics on the pigeonpea variant line along with other extra-early maturing lines of pigeonpea at Pantnagar during kharif, 1984

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Variant</th>
<th>Pant A-3</th>
<th>UPAS-120</th>
<th>Prabhat</th>
<th>ICPL-313</th>
<th>ICPL-316</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days to flower</td>
<td>45</td>
<td>78</td>
<td>82</td>
<td>76</td>
<td>69</td>
<td>69</td>
</tr>
<tr>
<td>Days to maturity</td>
<td>96</td>
<td>130</td>
<td>138</td>
<td>129</td>
<td>121</td>
<td>123</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>77</td>
<td>155</td>
<td>195</td>
<td>148</td>
<td>125</td>
<td>124</td>
</tr>
<tr>
<td>Fruiting branching</td>
<td>8</td>
<td>9</td>
<td>16</td>
<td>10</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Pods/plant</td>
<td>36</td>
<td>33</td>
<td>75</td>
<td>40</td>
<td>39</td>
<td>43</td>
</tr>
<tr>
<td>Seeds/pod</td>
<td>3.70</td>
<td>3.50</td>
<td>3.75</td>
<td>3.65</td>
<td>3.40</td>
<td>3.75</td>
</tr>
<tr>
<td>100 seed weight (g)</td>
<td>7.30</td>
<td>8.10</td>
<td>7.15</td>
<td>6.85</td>
<td>7.05</td>
<td>7.90</td>
</tr>
<tr>
<td>Plant type</td>
<td>Determinate</td>
<td>Determinate</td>
<td>Indeter-</td>
<td>Deter-</td>
<td>Deter-</td>
<td>Deter-</td>
</tr>
<tr>
<td>Disease reaction:</td>
<td></td>
<td></td>
<td>minate</td>
<td>minate</td>
<td>minate</td>
<td>minate</td>
</tr>
<tr>
<td>(a) Sterility mosaic</td>
<td>S</td>
<td>R</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>(b) Stem blight</td>
<td>S</td>
<td>R</td>
<td>S</td>
<td>S</td>
<td>___</td>
<td>___</td>
</tr>
</tbody>
</table>

S = Susceptible; R = Resistant

120, Prabhat, ICPL-313 and ICPL-316, were also raised. Observations on the variant line and these extra early maturing lines were recorded for flowering period, days to maturity, and height at maturity, along with the yield contributing and other traits.

The variant line was quite uniform with respect to phenotypic characteristics. Observations made on the variant line and extra early maturing lines are given in table 1. Variant line flowered 24 days earlier than the earliest maturing lines (ICPL-313 and ICP-316), and 37 days before the UPAS-120, an extra early commercial variety of pigeonpea. The variant line matured in 96 days and it was 25 days earlier than the earliest maturing line, ICPL-313, and 42 days earlier than UPAS-120.

Another important characteristic, which can be manipulated in designing the new plant type in pigeonpea, was the semidwarfness of the variant line. At maturity, the variant line attained a height of 77 cm, much less than the extra early maturing pigeonpea lines (table 1).

As regards yield components and other traits, the variant line was more or less similar to that of other lines (table 1).

Pigeonpea has a wide range of variability with respect to maturity period. Depending upon the maturity period, pigeonpea germplasm is broadly identified in five maturity groups, such as extra early types (110–130 days), early types (130–160 days), medium types (160–180 days), mid-late types (180–200 days), and late types (230 days)¹. On the basis of these types, different cropping systems are followed in various agroclimatic conditions. Extra early maturing varieties, like UPAS-120 and Prabhat, of pigeonpea, maturing around mid-November are becoming increasingly popular in northern India and have extended areas for pigeonpea cultivation.

The maturity time of extra early varieties coincides with the planting time of wheat, and hence, practically, very little time is left to prepare fields for timely sown wheat. Obviously, under such conditions, the pigeonpea varieties maturing well before the planting time of Rabi crops (e.g. the present variant line of pigeonpea which matures in mid-October) have immense value in increasing area and productivity of pigeonpea. Along with ultra-earliness, semidwarfness of the variant line can provide additional advantages in managing the pigeonpea crop. It provides easier application of insecticides, intercultural operations, suitability to mechanical harvest, increase in plant population and in the absence of excessive vegetative growth partitioning of more photosynthetic toward grains. A few seeds of this pigeonpea variant are available from the authors on request for breeding purposes.

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