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Robusta-like Coffee Plants with Arabica-like Cup Quality- Myth or Possibility?

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SUMMARY

Presently arabica coffee plantations suffer serious damage due to ravages of white stem borer (*Xylotrechus quadripes* Chev.) and leaf rust (*Hemileia vastatrix*, B.& Br.) resulting in substantial crop loss whereas robusta coffee is relatively less affected by both these pests. The breeding and release of C x R variety from CCRI, India is a step in developing coffee plants that look like robusta but with improved cup quality. In the present study, a natural triploid of C x R was crossed with Catimor arabica and the progeny segregated into 70% tetraploid C x R types and 30 % Catimor types with C x R types showing freedom from rust, self pollination upto 50 % and cup quality characterized by fair to good body, slight to fair acidity and light + flavor notes indicating taste nuances of both arabica and robusta.

INTRODUCTION

Robusta coffee is known for its general robustness with less susceptibility to leaf rust (*Hemileia vastatrix* B & Br.) and white stem borer (*Xylotrechus quadripes* Chev.), thick plump beans producing a strong, bitter brew lacking in aroma and acidity. Arabica coffee on the other hand is susceptible to the attack of leaf rust (to varying degree on different varieties) and white stem borer and produces thinner, broader beans yielding a thin brew with characteristic aroma and acidity. A question often asked by planters and researchers is whether it is possible to produce coffee plants that look like robusta with its natural resistance/ tolerance to leaf rust and white stem borer but with a cup quality similar to arabica. Breeding programs involving crossing of arabica with robusta initiated in several countries with this objective (Capot, 1977; Cramer, 1957; Monaco et al., 1974; Srinivasan and Vishveshwara, 1980) have not given desired success because of backcrossing with arabica which drives the hybrid more towards arabica making it susceptible to both the enemies.

The breeding and release of Congensis X robusta (C x R) hybrid from CCRI, India (Anonymous, 1998) which was earlier known as Congusta in Dutch East Indies (present Indonesia) (Cramer, 1957) is a step in developing coffee plants with robusta phenotype but with cup quality described as “one of sweetness and soft buttery notes- cup nuances which are indeed rare in the robusta strain“ (Sunalini N. Menon, 2000). However the cup quality of C x R, although better than that of other robusta, is not nearer to arabica because it lacks acidity and flavor. Hence an effort was made to cross C x R with arabica, the result of which is reported in this article.

MATERIAL AND METHODS

C x R is a diploid with $2n = 22$ chromosomes like robusta. It cannot be easily crossed with arabica which is a tetraploid with $2n = 44$ chromosomes. Even if crossing is possible, the

resulting progeny will be triploid with $2n = 33$ chromosomes and will be sterile yielding no seed. Sometimes shortcuts are possible in breeding if desirable plants are tailor made in nature. A weak looking plant with no fruit or seed set was identified in a plot of C x R at Coffee Demonstration Farm of the Coffee Board at Gonicoppal in south Coorg (Figure 1). Its chromosome number was checked and found to be a triploid with $2n = 33$. It was used in crossing with Catimor arabica. Fruit and seed set was observed only when it was used as pollen parent. Resulting progeny of 33 plants was planted at Coffee Research Sub-station of the Board at Chettalli in 1998. The progeny segregated into 22 CxR like plants and 11 Catimor like plants (Figure 2 & 3). CxR types however appeared like tetraploids with thicker and broader leaves. Chromosome number confirmed their tetraploid ($2n = 44$) status. Flowering was observed in 2001. During 2002 all the plants were selfed by watering and bagging before general blossom. Percentage fruit and seed set, out-turn (fruit to clean coffee), grade percentage and cup quality were assessed during 2002 and 2003. Next generation was established at 4 farms of the Board.



Figure 1. Natural Triploid of C x R.



Figure 2. Catimor Plant.



Figure 3. F₁ of Catimor x Triploid C x R.

RESULTS AND DISCUSSION

Progeny showed fruit set under self-pollination ranging from 2.8 to 51.2% in CxR types and from 21.1 to 77.4% in Catimor types. Percentage of floats was 13.8 % in CxR types and 10% in Catimor types (Table 1). Out-turn ratio (fruit to clean coffee) was 7.5:1 in CxR types and 5.5:1 in Catimor types. Clean coffee grade percentages showed 27.2% peaberry and 46.6% 'A' grade beans (retained on 6.65 mm screen) in CxR types. The combined percentage of 'A' and 'B' (retained on 6.0 mm screen) grade beans was 59.1%. This grade profile was similar to that of standard CxR with normal bold beans and superior to that of ordinary robusta. All the CxR type plants were free from rust.

Table 1. Out-turn (Fruit to clean coffee) in Catimor x (CxR).

Description	Fruits (Kg)	Floats %	Wet Parchment (Kg)	Dry Parchment (Kg)	Clean coffee (Kg)	Out turn ratio
Arabica-like plants	10	10	3.85	2.05	1.80	5.5: 1
Robusta-like plants	12	13.8	3.50	1.80	1.60	7.5: 1

Table 2. Clean coffee grade percentages.

Description	Peaberry %	'A' grade %	'B' grade %	'C' grade %	Blacks,bits & browns %
Arabica-like plants	9.1	69.9	12.5	6.8	1.7
Robusta-like plants	27.2	46.6	12.5	5.7	8.0

Cup quality analysis revealed ‘Fair to good body; a neutral, fairly soft and smooth cup with hints of slight to fair acidity and flavor indicating taste nuances of both arabica and robusta’ (Table 3).

Table 3. Quality assessment of bean samples from Catimor x (CxR).

Year	Lab.	Raw	Roast	Cup
2002	Private Lab.	Medium to small. Oval.	Fairly even roast. Fair swelling. Sl. dull. Many open centers. Fairly even surface. Small % of chaff adhering.	Fair body. Fair+ to good acidity. Light+ flavor notes. Clean. Aftertaste is one of acidity. FAQ to Sl. above FAQ.
2002	Board’s Lab.	-----	-----	Good Body, Sl. acidity Fairly Soft Fairly Neutral
2003	Private lab.	Greyish with a hint of brown	Fairly even roast. Good swelling. Slightly dull. Hint of shine. Many with open centers. Fairly smooth surface. Fair % of chaff adhering to the beans.	Fair+ to good. Neutral. Fairly soft & smooth. Clean. Hint of bitterness. Presence of acidic notes. A neutral, Fairly soft & smooth Cup. Rating: Good
2003	Board’s Lab.	Greenish grey. Oval oblong beans.	Even roast, medium-good swelling.	Medium to good body. Fair acidity. Slight flavor. Rating: FAQ+(Beans appear like robusta but tastes like arabica)

Segregation of open pollinated progeny from CxR types in the next generation of 2 years old plants has shown a proportion of 70% CxR types and 30% Catimor types out of a population of 346 plants which is similar to that of parental population. Pattern of segregation in the selfed progeny needs to be studied.

The above results have given an indication that it should be possible to evolve a population of coffee plants that phenotypically resemble robusta but with seed quality that has a mix of arabica and robusta.

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