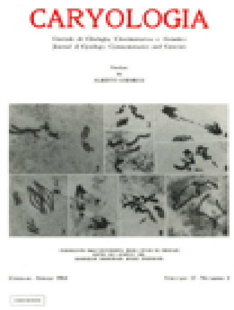

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A Study of Natural, Self and Cross (Dwarf × Tall) Progenies of Dwarf Coconuts of the West Coast of India and its Bearing on the Genetics of Dwarfs and the Putative Hybridity of their Off-Type Progenies

C. A. Ninan & K. Satyabalan

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A STUDY OF NATURAL, SELF AND CROSS (DWARF × TALL) PROGENIES OF DWARF COCONUTS OF THE WEST COAST OF INDIA AND ITS BEARING ON THE GENETICS OF DWARFS AND THE PUTATIVE HYBRIDITY OF THEIR OFF-TYPE PROGENIES

C. A. NINAN and K. SATYABALAN
Department of Botany, University of Kerala, Trivandrum
and Central Coconut Reseach Station, Kasarogod, India

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Dwarf coconuts are known to occur in most of the coconut growing countries. In the West Coast of India, there are at least two distinct races of dwarfs, namely, the dwarf orange (Fig. 1) and dwarf green (Fig. 2). They differ from each other in a number of well-defined characters like colour, shape and yield of nuts as well as quantity and quality of copra. While the dwarf greens of Chowghat are reported to show almost cent per cent adaptation for selfing, both self and cross pollination are frequent in the dwarf orange (RAO and KOYAMU 1955). Available reports also show that 80 per cent of the progenies of dwarf orange and 95 per cent of those of dwarf green breed true of type (RAO and KOYAMU 1955, SATYABALAN 1958). Among the Malayan dwarfs, however, the yellow type maintains the maximum purity of 96.2 per cent followed by 74.6 per cent in red and 68.7 in green (JACK and SANDS 1922).

The green variety of Malayan dwarfs are reported to be prone to throw a proportion of « semi-tall » progenies (ANON 1938). JACK (1925) considers that such progenies are possibly hybrids resulting from natural crossing of the dwarfs with talls. DWYER (1938), TAMMES (1949, 1955) and LIYANAGE (1956) also mention about the occurrence of natural hybrids of dwarfs with talls. SATYABALAN (1956) has reported that the 'natural crosses' of the dwarf orange type of Chowghat studied by him showed consistently reddish petiole colour, which, combined with their extra vigour in comparison with the pure dwarf seedlings make it easy to pick them out in the nursery. He has further mentioned that they are early and prolific bearers with superior quality of copra. WHITEHEAD (personal communication) mentions that the yeld of the 'semi-tall' progenies of the Malayan dwarf orange type studied by him is in excess of that of any of the introductions so far tested. Comparison of yield characters of the off-type progenies of the dwarf orange (Fig. 3) and green (Fig. 4) with the dwarf parental types, the West Coast Talls, and tall 'female' × dwarf 'male' hybrids planted in the Central Coconut Research Station, Kasaragod also shows that the off-type progenies of the orange dwarf in particular excels the West Coast Tall variety and the tall 'female' × dwarf 'male' hybrids in spathe production, yield of nuts, copra content per nut (Figs. 5, 6 & 7) as well as total annual out-turn of copra (Table I). They are also better than most of the introductions so far tested in the Central Coconut Research Station, Kasaragod (NINAN *et al.*, 1961, NINAN and PANDALAI 1962). This superiority in yield characters and the relatively early bearing habit of the off-type progenies of dwarfs make their commercial planting a very economic proposition. In fact, TAMMES (1955) and LIYANAGE (1956) have suggested that such hybrids could be produced on a large scale by interplanting dwarf and tall coconuts and regularly emasculating the dwarfs to facilitate their crossing with talls.

Attempts to produce such hybrids by controlled dwarf × tall crosses, have however, so far failed to give expected results in that there is high failure of germination of the resulting nuts and some of the progenies turn out to be dwarfish (PATEL 1937, LIYANAGE 1956, Madras Agric. Station Rep. 1936-37 and 1940-41, WHITEHEAD, personal communication). Available reports on such crosses further indicate that the resulting hybrids show very variable performance. Thus, while the few hybrids obtained by LIYANAGE (1956) out of several crosses conducted by him in Ceylon showed comparable performance as the reciprocal tall × dwarf hybrids, but with a little late flowering, those evolved in the Agricultural Research Station, Nileshwar, India were poorer than even the dwarf parental type in nut characters and copra content, as data extracted from the Station reports (1940-41) and presented in Table II reveal. The appearance of pure dwarf progenies in dwarf × tall crosses conducted by him has been explained by LIYANAGE (1956) as the result of possible contamination with dwarf pollen at the time of pollination.

With a view to critically examine the reported failure of dwarf × tall crosses and to elucidate the genetical status of the off-type progenies of dwarfs, a comparison of the progenies (seedlings) of the dwarf orange and green types obtained by natural, self and cross-pollination (with talls) was made. Adult off-type plants of the orange and green types were also selfed and the progenies studied. Data on germination percentage of nuts, percentage mortality of young sprouts, fre-

Fig. 1. — A five year old palm of the Chowght dwarf orange variety.

Fig. 2. — A five year old palm of the Chowght dwarf green variety.

Fig. 3. — A twenty year old off-type progeny of the orange dwarf. Note the heavy bunches of nuts in the crown.

Fig. 4. — A seven year old off-type progeny of the dwarf green variety.

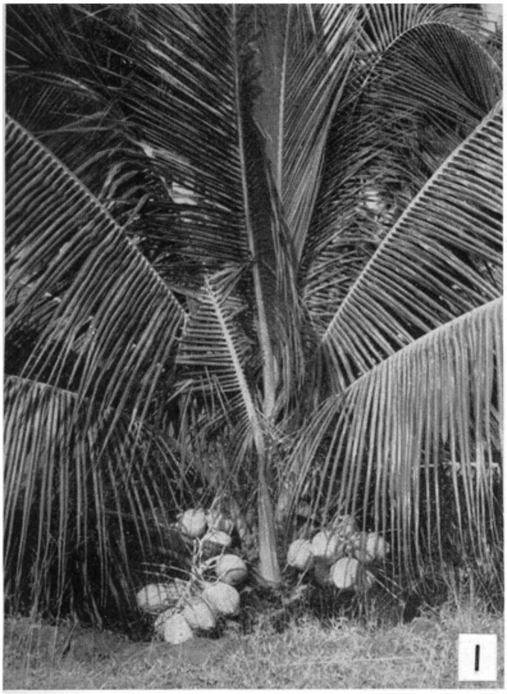
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TABLE I

Comparison of the performance of pure dwarf green and orange their off-type progenies, tall 'female' × dwarf 'male' hybrids and West Coast Talls in the Central Coconut Research Station, Kasaragod.

Variety and Tree No.	Mean No. spathes produced	Mean No. female flowers	Mean yield of nuts	Setting percentage	Mean Copra content per nut (gms.)	Estimated yield of copra per palm per year (kilos)
Dwarf green						
1. IXE/39	8.8	255.6	48.7	20.3	38.3	1.9
2. IXE/37	8.7	259.5	46.2	20.0	32.5	1.4
3. IXE/24	6.6	183.2	33.2	20.1	49.2	1.6
Average	8.0	232.7	42.7	20.1	40.0	1.6
Dwarf orange						
1. IXE/54	6.8	120.1	42.0	35.4	156.9	6.6
2. IXE/55	7.5	99.3	34.0	35.7	170.3	5.8
3. IXE/56	8.3	208.6	67.5	37.4	134.0	9.0
4. XI/71	8.8	231.7	70.8	32.3	186.0	13.2
Average	7.9	164.9	53.6	35.2	161.8	8.7
Off-type progenies of dwarf green						
1. IXE/50	10.5	212.3	67.5	33.4	190.8	12.9
2. IXE/44	10.8	316.1	93.0	26.0	138.5	12.9
3. IXE/43	12.0	228.7	65.5	27.5	168.6	11.0
4. IXE/41	11.8	290.3	79.8	28.5	163.7	13.1
5. IXE/31	12.7	296.8	60.8	20.8	209.2	12.7
6. IXE/40	11.1	214.0	54.5	25.7	151.7	8.3
7. S.B./660	11.0	235.0	62.0	26.4	253.4	15.7
Average	11.4	256.2	69.0	26.9	182.3	12.3
Off-type progenies of dwarf orange						
1. O.C. 1	15.2	464.5	160.2	35.7	194.7	31.2
2. XI/1	14.8	534.4	131.7	25.1	215.5	28.4
3. XI/2	12.6	311.3	106.7	34.5	198.2	21.1
4. XI/3	13.3	269.3	105.8	40.0	213.2	22.6
5. XI/4	14.3	291.5	122.2	40.9	212.8	26.0
6. XI/15	13.0	420.6	129.1	31.1	179.1	23.1
7. XI/68	14.7	305.8	114.5	38.8	231.6	26.5
8. XI/69	11.4	326.5	94.3	31.1	215.9	20.4
9. XI/76	9.9	247.8	101.5	44.0	204.0	20.7
Average	13.2	352.4	118.4	35.7	207.2	24.4
Tall 'female' X dwarf 'male' hybrid						
1. XI/18	14.5	553.0	130.4	24.6	184.4	24.0
2. XI/19	12.0	308.1	105.5	34.7	164.1	17.3
3. XI/20	10.5	264.9	85.1	30.8	233.9	19.9
Average	12.3	375.3	107.0	30.0	194.1	20.4
West coast tall						
1. XI/21	7.9	229.1	89.7	39.3	188.0	16.9
2. XI/22	12.9	313.0	93.4	30.5	191.2	17.9
3. XI/24	13.9	211.5	77.2	36.9	153.3	13.0
	11.5	251.2	86.7	35.6	177.6	15.9
Average values for 65 high yielding trees at kasaragod			95.6		157.6	15.3

TABLE II

Copra characters of talls, dwarfs and their hybrids.

Particulars of trees		Meant wt. of copra per nut. (gms.)	Mean thickness of kernel (mm.)	Pertange ot oil
Parent tree	— Tall	163.64	11.64	71.79
»	— Dwarf	126.61	9.63	—
Progenies	— Tall 'female' × Dwarf 'male'	138.17	11.65	72.26
»	— Dwarf 'female' × tall 'male'	46.15	8.50	—

quency of off-type seedlings as well as progenies breeding true to type in natural, self and cross-progenies of the two dwarf types are presented in Table III.

Perusal of Table III reveals several interesting aspects. Out of 265 open-pollinated nuts (derived from 11 dwarf orange trees), 40 nuts failed to germinate and

TABLE III

Germination percentage and frequency of off-type seedlings in natural, cross and self progenies of the dwarf orange and green types.

Variety	Nature of seednut.	No. of nuts sown.	Ungerminated nuts.	Dead sprouts.	Percentage of ungerminated nuts & dead sprouts.	No. of seedlings obtained.	No. of «Off-type» seedlings.	Percentage of «Off-type» seedlings.
Dwarf orange	Open-pollinated.	265	40	121	60.7	104	43	41.3
Dwarf orange	Dwarf 'female' × Tall 'male'	209	64	72	65.0	73	38	52.0
Dwarf orange	Self	89	5	12	19.1	73	31	42.4
Dwarf green	Open-pollinated.	206	37	15	25.2	154	26	16.8
Dwarf green	Dwarf 'female' × Tall 'male'	43	10	—	23.2	33	8	24.2
Dwarf green	Self	77	20	8	36.3	49	18	36.7

121 showed death of young sprouts, the two groups accounting for 60.7 per cent of the nuts sown. Out of the seedlings obtained, 41.3 per cent were off-types with reddish petiole colour; the others bred true to the orange colour of the dwarfs. The off-type progenies showed greater vigour than the pure dwarf seedlings (Fig. 8). It would be quite tempting to compare the above situation with what is observed under controlled dwarf × tall crosses. Though available reports show as low a germination percentage as 15.8 in such crosses (Madras Agric. Station Reports, 1934-35), the present study reveals that there is essential similarity in behaviour of open pollinated and dwarf × tall seednuts in germinability and incidence of lethals in the progeny. Thus out of 209 hybrid nuts studied, 64 failed to germinate and 72 showed death of young sprouts, the two groups accounting for 65 per cent of the number of nuts sown. Fifty-two per cent of the seedlings obtained resembled the natural off-types in vigour and petiole colour, the rest being purely dwarfish. Irrespective of the colour characters of the pollen parents used, all the off-type progenies showed reddish petiole colour. The more or less comparable frequency of off-types in open pollinated and cross progenies of the dwarf orange and their characteristic reddish petiole colour and matching vigour clearly points to essential similarity of the off-type progenies obtained from natural and cross pollination. The occurrence of a good proportion (52 per cent) of pure dwarf types in dwarf × tall crosses is however intriguing. In the case of the dwarf greens also the behaviour of open-pollinated and cross (dwarf × tall) progenies showed close agreement in the incidence of lethals, percentage of off-type progenies and those breeding true to type, as revealed from data in Table III. Unlike the situation in the orange dwarf in which the off-types could be easily distinguished by their reddish petiole colour, their separation in the green dwarf is very difficult as most of them show green colour like the pure dwarfs. Thus in both orange and green types, controlled crossing with talls did not yield a different result from what happens under open pollination.

Controlled self-pollination of the dwarfs gave extremely interesting results. Out of 89 selfed nuts of the orange dwarf sown in the nursery, 5 did not germinate and 12 showed death of young sprouts. The lethals thus accounted for 19.1 per cent of the nuts and this contrasts strongly with the 60.7 per cent lethals in natural seeds and 65 per cent in dwarf tall hybrid seeds of this type. More illuminating however, is the observation that among the self progenies there was clear

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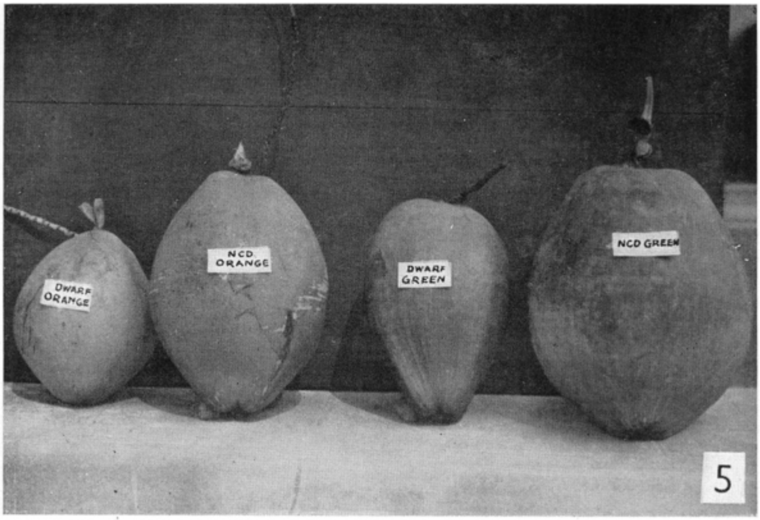
Fig. 5. — Mature nuts of the orange and green dwarfs and their off-type progenies. Note the size differences of nuts of the dwarfs and the off-types.

Fig. 6. — Mature nuts of the orange and green dwarfs and their off-type progenies split open to show the internal parts.

Fig. 7. — Copra of the orange and green dwarfs and their off-types. Note the size of copra of the off-types.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NCD ORANGE
DWARF GREEN
NCD GREEN

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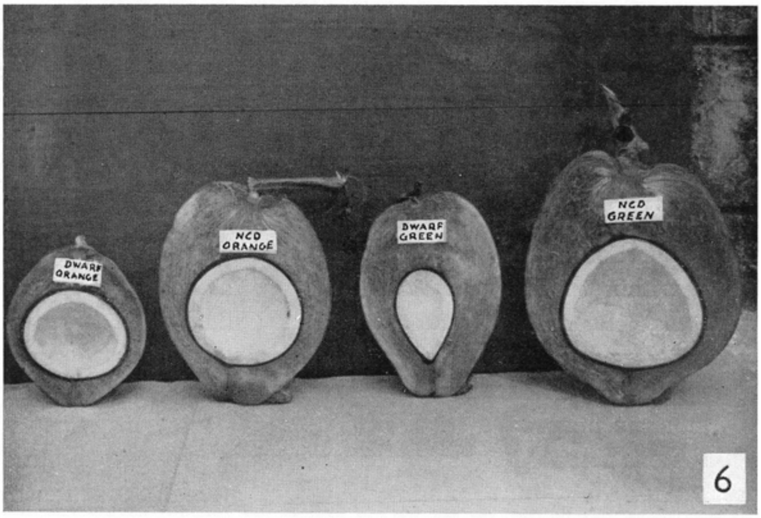
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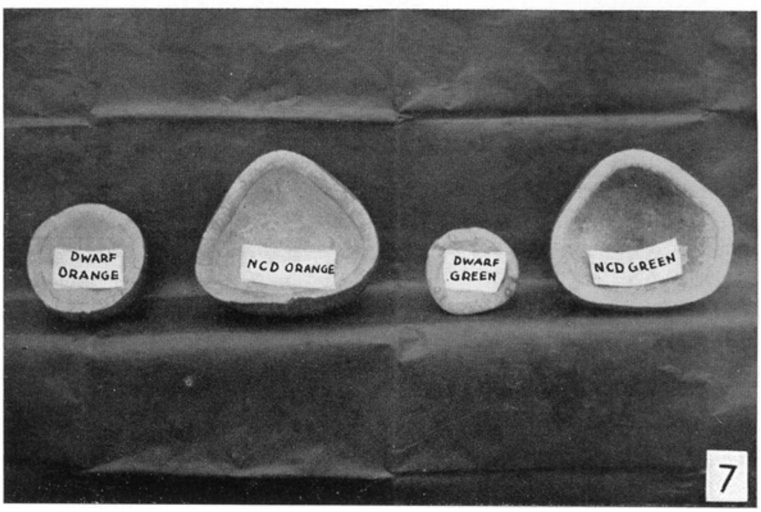
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segregation of off-types which resembled the natural off-type progenies in the characteristic reddish petiole colour and the frequency of occurrence (Figs. 9 and 10). Thus 41.3 per cent of the natural progenies and 42.4 per cent of the self-progenies of the orange dwarf belonged to this category. Both the pure and the off-type seedlings of the orange dwarf obtained by selfing however appeared to show slight reduction in vigour compared to their counterparts obtained from openpollination and dwarf × tall crosses. Such differences however were not so pronounced in the case of the green dwarf. It is of interest in this connection that the green dwarfs are genetically more pure than the orange dwarf (RAO and KOYAMU 1955), a conclusion well supported by evidences from vegetative and yield characters.

The segregation of off-type progenies under selfing of dwarfs throws valuable light on the genetics of the dwarfs themselves as well as the putative hybridity of the natural off-type progenies of dwarfs. In the first place, it shows that the dwarfs, particularly the Chowghat orange type is not homozygous to the extent now conceived. HARLAND (1957) has pointed out that since the dwarfs are largely self-pollinated and their progeny reasonably homogeneous, the progenies of single bunches on a palm, each with a different male of the tall variety, could be studied to identify the most prepotent talls. The high frequency of ungerminated nuts and dead sprouts in dwarf 'female' × tall 'male' crosses, the fact that a good proportion of the progenies turns out to be of the pure dwarf type, the variation within the off-types and the uncertainty about their hybridity clearly show that Harland's suggestion is not practicable as far as the Indian dwarfs are concerned. SWAMINATHAN and NAMBIAR (1961) have stated that, if the view that some dwarf coconuts represent stable inbred lines is correct, they may serve the same purpose as autodiploids derived from haploids in breeding experiments. The inherent variability of dwarfs as revealed from data on selfing, clearly shows that their value as autodiploids in breeding experiments is very doubtful. The slight reduction in vigour of the seedlings obtained by self-pollination of dwarfs and the appearance of a good proportion of off-type progenies under selfing suggest clearly that the dwarfs have in them a store of genetic variability. That the dwarf coconuts may not be genetically very pure is also borne out from observations on Malayan dwarfs (DWYER 1938, ANON 1938, WHITEHEAD 1961). According to Marechal (1928) cross-pollination is more the rule

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Fig. 8. — A view of a nursery raised from open pollinated nuts of the orange dwarf. Note the vigorous off-type seedlings amidst the weaker pure dwarf seedlings.

Fig. 9. — Off-type (left) and pure dwarf (right) seedlings of the orange dwarf raised from open pollinated nuts. Note the relative differences.

Fig. 10. — Off-type (left) and pure dwarf (right) progenies raised from selfed nuts of the orange dwarf. Note the relative differences.

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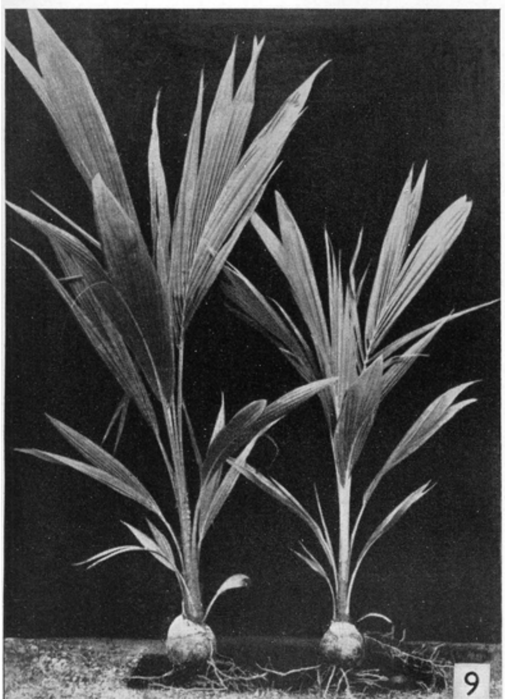

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with the dwarfs growing in Fiji and this would indicate that the ' Fijian dwarfs ' might also be heterozygous.

It would be of interest in this connection to consider how the dwarfs themselves originated. They have been considered by many to be of mutant origin from the talls (HANDOVER 1919, ANON 1921, DWYER 1938, MENON and PANDALAI 1958). JACK and SANDS (1922) remark that « although no experiment on Mendelian lines has been made so far, we should expect to find that the Malayan dwarf form is a recessive mutant with perhaps only a single factor concerned, but as Dr. Bateson pointed out in his Croonian lectures of 1920, quantitative differences, for example, those relating to size and height seldom if ever have a perfectly simple inheritance ». PANCHO (1960) has pointed out that the dwarf palm *Tambulilid* of the Philippines might be a recessive mutant with only a single factor involved. He has further stated that « according to information given by a grower, the original tree where the plantation originated comes from San Miguel Island in Tobago, Albay. It is about thirty-six years old now ». SWAMINATHAN and NAMBIAR (1961) have however suggested that the dwarf and semi-dwarf coconuts occurring in different countries may be products of inbreeding in different tall varieties. According to them, an initial mutation, if any, responsible for the origin of the dwarf coconut might have led to the overlapping of the male and female phases of the inflorescence, thus rendering self-pollination both possible and predominant. However, self-pollination can occur in the tall palms during certain seasons and a mutation facilitating this process is not a prerequisite for inbreeding to occur.

Though there is thus difference of opinion as to the mode of origin of dwarf coconuts, their derivation from ancestral tall types is never disputed and evidences from morphology, breeding system and cytology unequivocally point to this conclusion. Comparison of meiosis in talls and dwarfs (SHARMA and SARKAR 1956, NAMBIAR and SWAMINATHAN 1960*a*, *b*, NINAN *et al.* 1961, ABRAHAM *et al.* 1961) shows that there is more stable meiosis in the former. Since more stable meiosis is met with in wild types (LINDQUIST 1960) it follows that the dwarfs are later derivatives from tall palms. STEBBINS (1957) has adduced conclusive evidences to show that types which are regularly self-pollinated most probably are always derived from cross-fertilising ancestors and that « self-fertilisers have been the victims of an unlucky accident ». It is thus clear that dwarf coconuts owe their origin to talls and depending on whether they are one step mutants or products of several generations of inbreeding, one may expect differences in their genetic content also. Varieties like the *Tambulilid* which are of quite recent mutant origin might thus be heterozygous like the talls while others with a long history of inbreeding might be reasonably homozygous, provided there are no barriers to free recombination in them. Evidences from cytology of dwarfs (SWAMINATHAN and NAMBIAR 1961) reveal that they are heterozygous for chromosomal rearrangements like translocations and inversions. Evidently these could reduce the recombination potential and lead to linking together of certain blocks of genes resulting in the preservation of some amount of heterozygosity. A certain amount of heterozygosity may also be preserved in the dwarfs by positive selection, since this may be necessary for their continued survival under progressive inbreeding.

Even though the natural off-type progenies of the dwarfs have been believed by many to be hybrids of dwarfs with talls, the segregation of similar off-type seedlings under self-pollination of dwarfs observed in the present study show that they can as well be heterozygous segregates from dwarfs, possibly with imposed hybridity. The appearance of dwarfish progeny in dwarf × tall crosses to the extent of ca. 50% in the dwarf orange and ca. 75% in dwarf green is however intriguing and a proper explanation to this can perhaps be found only by a better understanding of the genetics of the character of dwarfness in coconuts. In view of the discrepant results from dwarf × tall crosses, it would be quite interesting to see whether pollination of dwarfs with tall pollen is really effective in the production of hybrids or it acts only as a stimulus for apomictic reproduction as suggested by SHARMA and SARKAR (1956).

There is also the possibility that the off-type progenies of dwarfs might be products of dwarf × dwarf crosses taking place in nature. In fact, SWAMINATHAN and NAMBIAR (1961) have suggested dwarf × dwarf crosses as a method of exploiting hybrid vigour in coconuts. The only report of dwarf × dwarf cross in literature is that between the Fiji dwarf (*N'uleka*) and the Malayan dwarf (MARECHAL 1928). It is reported that in the hybrids *N'uleka* characters predominated. There was considerable variation in the progeny and some of them turned out to be high yielders (SURRIDGE 1932, PARHAM 1953). The reported variability in the hybrid progenies clearly shows that all dwarf × dwarf combinations do not give rise to vigorous hybrids. It is also not known whether the high-yielding selections from the hybrid progenies resembled the natural off-type progenies of the particular dwarf type in question. It is, however, clear that even in dwarf × dwarf crosses, only a proportion of the progenies show vigour and desirable yield characters. Unfortunately data on controlled selfing of these dwarfs are not available. In the West Coast of India, the two races of dwarfs commonly seen in plantations and that could possibly hybridise are the orange and green types. Results of crosses between these two types conducted in this station, however, do not support the assumption that the natural off-type progenies of the dwarfs might be hybrids between these two types. Comparison of copra characters of a few dwarf × dwarf hybrids (Table IV) evolved in the Kasaragod station with those of the off-type progenies of dwarfs given in Table I shows that the latter are much more superior to the dwarf × dwarf hybrids, which themselves are little or no better than the pure dwarfs. There is another possibility that they

TABLE IV
Copra characters in a few dwarf × dwarf hybrids and their parental types.

Name of cross	Copra content per nut		
	female	male	hybrid
A. *Dwarf green × D. orange*			
1. IXE/34 × IXE/56	129.0	134.0	146.4
2. do	129.0	134.0	104.2
3. do	129.0	134.0	142.9
4. do	129.0	134.0	111.5
Average			126.2
1. IXE/23 × XI/71	108.6	182.3	142.9
2. do	108.6	182.3	141.8
Average			142.3
B. *Dwarf orange × D. green*			
1. IXE/56 × IXE/34	134.0	129.0	122.0
2. do	134.0	129.0	122.4
3. do	134.0	129.0	150.9
4. do	134.0	129.0	144.6
Average			134.9
C. S. S. *Apricot × D. green*			
1. XI/62 × IXE/34	161.3	129.0	131.9
2. do	161.3	129.0	74.5
3. do	161.3	129.0	150.6
4. do	161.0	129.0	116.6
Average			118.4
1. XI/62 × IXE/23	161.3	108.6	132.0
2. do	161.3	108.6	78.9
3. do	161.3	108.6	152.5
Average			121.1

may be products of inbreeding between individual dwarfs of the same variety. Since it is to be expected that there should be tree to tree variation within dwarfs of the same variety, combinations between different trees might yield vigorous progenies. This can be verified by controlled crosses between dwarf palms of the same variety.

A solution of the problem regarding the hybridity of the off-type progenies of dwarfs is associated with knowledge on the genetics of the character of dwarfness in coconuts. Available evidences on the genetics of dwarf coconuts do not seem to establish beyond doubt whether dwarfness is due to a single gene or genes at many loci and whether it is a dominant or recessive trait. HALDANE

(1958) has made the following observations regarding the genetics of the dwarf coconuts. « If does not seem to be known whether the character of dwarfness is mainly due to a single gene (which may be provisionally called *D*, since the heterozygotes *Dd* are intermediate between *DD*, dwarf and *dd*, tall in some characters. Il dwarfness is mainly due to a single gene, the following questions arise. Are the hybrids (tall 'female' × dwarf 'male') superior mainly because they are *Dd* or is this superiority due to genes at many loci? If the former hypothesis is correct, then *Dd* × *dd* or *dd* × *Dd* should give about equal numbers of Dd and dd and the former should be superior from an economic point of view ». Controlled selfing of the off-type progenies of the dwarf orange and green types shows that there are clearly dwarfish segregates in the progeny. Pure dwarf seedlings also arise in open pollinated progenies of the off-types. These evidences seem to support the possible hybridity of the off-types. The F_1s of the tall 'female' × dwarf 'male' crosses as well as the natural off-type progenies of dwarfs show complete dominance as far as the out-breeding system characteristic of the tall coconuts is concerned. In stature, the tall 'female' × dwarf 'male' hybrids appear to be intermediate between the talls and dwarfs, whereas, the natural off-type progenies of dwarf mothers are almost indistinguishable from the talls. As far as earliness is concerned, both the off-type progenies of dwarfs and the tall × dwarf hybrids are intermediate between the parental types, but the off-types show relatively late bearing compared to the tall × dwarf hybrids (LIYANAGE 1956; observations in the Central Coconut Research Station, Kasaragod). If the off-type progenies of dwarfs are really hybrids with talls, it is rather unexpected to find that they are relatively later to bear compared to their reciprocal hybrids, especially in view of the fact that they are derived from dwarf mothers.

It would thus appear that, as it stands, the problem of the genetical status of the off-type progenies of dwarfs is quite intriguing. There can be no doubt that this can be elucidated only with a better understanding of the genetics of the character of dwarfness in coconuts. Coconut being a perennial species with a long pre-bearing period (3-4 years in the dwarfs and 6-8 years in the talls), it presents unique problems in genetic experimentation. While this accounts for the dearth of genetic information on the palm, its importance as a major commodity crop of the tropics calls for sustained efforts on the genetic improvement of the palm.

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SUMMARY

Comparison of yield performance of the dwarf orange and green coconuts of the West coast of India, their off-type progenies, tall 'female' × dwarf 'male' hybrids and West Coast Talls grown in the Central Coconut Research Station, Kasaragod showed that the off-type progenies of the orange dwarf are very economic yielders. Though they have been considered by earlier workers to be products of out-cross of the dwarfs with tall 'males', controlled crosses conducted in this Station show that ca. 50% of the progenies of dwarf orange 'female' × tall 'male' and ca. 75% of those of dwarf green 'female' × tall 'male' crosses turn out to be of the purely dwarfish type. Irrespective of the colour characters of the tall pollen parents used, the off-type progenies of the orange dwarfs showed reddish petiole colour; those of the green dwarf were mostly green. Under controlled selfing of the orange dwarf, seedlings resembling the natural off-type progenies were obtained in the same frequency as under open pollination. They, however, revealed slight inbreeding depression. The results of selfing suggest that dwarf coconuts are not homozygous to the extent now conceived and that the off-type progenies of dwarfs might be heterozygous segregates, perhaps with imposed hybridity. The appearance of pure dwarfs in dwarf × tall crosses in more or less the same proportion as in natural progenies of dwarfs is intriguing and inexplicable and an answer to this can possibly be had only by a better understanding of the genetics of the character of dwarfness in coconuts.