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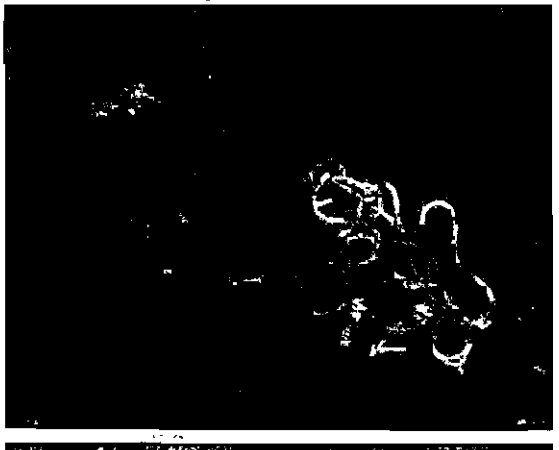
NATIONAL RESEARCH CENTRE FOR SPICES

CALICUT - 673 012, KERALA, INDIA



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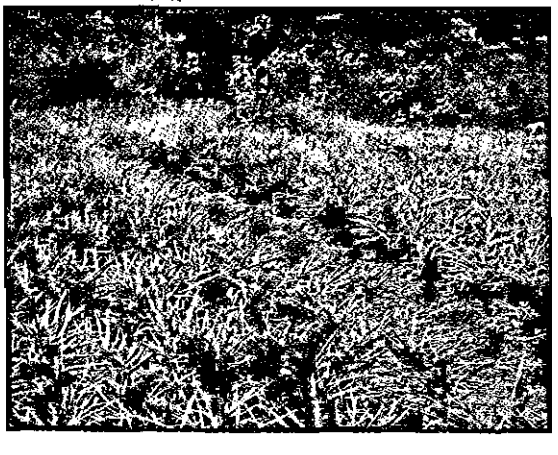
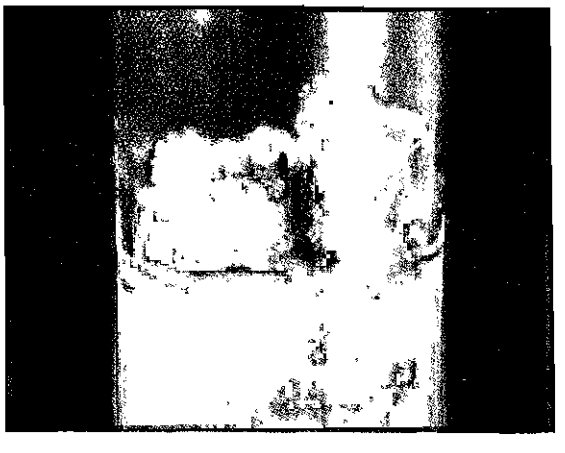
RESEARCH HIGHLIGHTS 1991-92



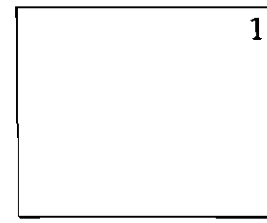


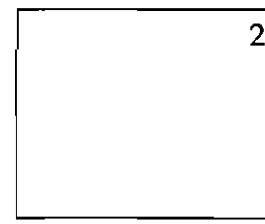
Cover Photo :

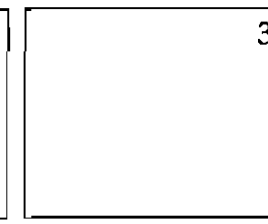
1. *Hexamermis* spemerging out of parasitized larva of top shoot borer.

2. Soil solarisation reduced soft rot incidence in ginger.

3. Proliferation of mace tissue in culture.







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INTRODUCTION

National Research Centre for Spices, Calicut completed six years of its existence on 01-04-1992. The year 1991-92 witnessed an encouraging trend in the spices research output. Fifty-six collections consisting of eleven *Piper* species including the much valued *Piper barberi* were made, karyomorphological studies of *Piper barberi* revealed that its chromosome number is 2n = 52 and chromosome length ranged from 0.74 to 1.85μ. Chromosome number of *P. barberi* is reported for the first time. Cytotypes in black pepper with chromosome numbers ranging from 2n = 52 to 104 were identified from the OP progenies of collection No. 1344 which itself was a triploid with 2n = 78. A genetic catalogue of one hundred cultivated black pepper accessions is being prepared. Fifty-six *Piper* accessions were evaluated for quality. The line CLTP-49 had 4.3% oil, 12.2% oleoresin and 4.8% piperine. Drying pepper on polyethylene sheets helps to obtain clean and dirt-free produce at the shortest time. *Phytophthora* foot rot of pepper and its management attracted considerable attention. Metalaxyl-ziram and metalaxyl-mancozeb were observed superior in disease suppression. Biological control of *Phytophthora capsici* through *Pseudomonas* species were attempted. The VAM *Glomus fasciculatum* showed good disease suppression in black pepper rooted cuttings caused by *Phytophthora capsici* and *R. similis*. The line P-24 was observed tolerant to *Phytophthora capsici* in trials conducted at Sirsi (Karnataka).

Twenty seven cassia collections are made. Fifty two elite nutmeg trees are identified in private farmers' fields based on detailed survey and evaluation. Propagation studies in tree spices indicated approach grafts of clove to be early bearers and dwarfs. Juvenile allspice cuttings dipped in a commercial rooting hormone gave 50% rooting. Top working of nutmeg by grafting was successful.

Biotechnology research on spices made significant advances. Micro propagation of *Piper chaba* and *Piper longum* were standardized. Callus cultures of *Piper longum, Piper chaba* and *Piper colubrinum* were established. *In vitro* proliferation of mace was made possible. Shoot tip cultures of nutmeg, clove, cinnamon and allspice were established.

Biological control of insect pests on spices received due attention. Natural enemies of top shoot borer were identified as *Hexamermis* sp. *Clinotrombium* sp. and *Apanteles cypris*. The scale insect *Lepidosaphes piperis* was the most prominent species occurring in pepper. Biological control of the nematode *Meloidogyne incognita* using the fungus *Paecilomyces lilacinus* was adopted. Fertilizer requirement of bush pepper is being standardized. During the year, a total of 25,500 single noded rooted cuttings of pepper were distributed.

All India Co-ordinated Research Project on Spices completed twenty one years' of its existence. Eleven varieties of spices were identified for high yield/quality during 1991 alone. The cardamom clone P-6 showed good degree of drought tolerance. The year 1991-92 had also its calamities. The *Phytophthora* foot rot in black pepper has become catastrophic.

Highlights of the findings of the period 1991-92 are dealt with in the following pages.

Calicut-12
8.5.1992

(K.V. PETER)
DIRECTOR

GENETIC RESOURCES

Black pepper

Collection surveys were undertaken at different forest ranges of Western Ghats in Kerala and Tamil Nadu and 56 collections were made consisting of eleven *Piper* species, including *P. barberi*, an hitherto unreported species from Anamalai hills. *P. barberi* was redescribed based on characters of female plants as well. Cytological analysis revealed that the chromosome number of *P. barberi* is 2n = 52 and the chromosome length ranged from 0.74 to 1.85 u. *P. arboreum*, a South American species and 4 cultivated types from Malaysia and Indonesia were added to the germplasm.

A catalogue was prepared for 100 cultivated black pepper accessions and the cultivars were classified based on morphology of leaves, spikes and quality characters.

Correlation studies revealed significant character association between bisexual flowers and setting (%), spiking intensity and spike length, spike length and leaf length/breadth, oleoresin and piperine/essential oil.

A cluster analysis based on 30 characters led to grouping of 8 *Piper* spp. into 6 distinct groups based on similarities:

They are:

(1) *P. attenuatum, P. argyrophyllum*
(2) *P. galeatum, P. trichostachyon, P. schmidtii*
(3) *P. mullesua, P. silentvalleyensis*
(4) *P. hymenophyllum*
(5) *P. nigrum, P. nigrum* var. *leiospicata, P. wightii*
(6) *P. longum*

The intercluster D^2 analysis was not significant among groups 1 to 4 indicating their affinity and relativeness. The major characters/sets of characters which led to divergence of the species also were worked out. Analysis of the flavonoid profiles of the species supported the above results.

Ginger and turmeric

A tetraploid line of ginger cv. Mananthavadi was added to the germplasm collections of ginger. Two species each of *Zingiber* and *Curcuma* were collected from Western Ghat forests and added to the gene bank.

Tree spices

Twenty seven cassia collections from Anamalai, one wild cinnamon from Meghalaya, two *Cinnamomum tamala* (Tejpat) and two wild cinnamon collections from Bihar, fifty one collections of *Myristica fragrans* and four wild nutmeg collections including *M. anadamanensis* and *Knema andamanica* from Andamans are the important germplasm additions. Among the 51 collections of *M. fragrans*, the most important one is the tree producing fruits having 3 sutures on their pericarp and within each fruit two to three seeds fused to form a stout, irregularly shaped seed with rich aril and another small rudimentary seed.

CROP IMPROVEMENT

Black pepper

Black pepper hybrids HP-732 and HP-813 were superior among the 100 hybrids evaluated at the high altitude trial at Valparai. In a separate evaluation of another 100 hybrids at Aralam farm, 2 hybrids of *Cholamundi* x Panniyur-1 (HP-846 and HP-833) are superior to other combinations.

A natural triploid of cultivated black pepper is identified for the first time. The cultivar (Coll. 1344) contained a somatic chromo-

some number of 78, which may even be treated as a hexaploid (2n = 6x = 78). Progenies of this cultivar exhibited high quantitative variation for many seedling traits. Somatic chromosome number of progenies varied from 2n = 52 to 104. A few of the progenies even resembled related wild *Piper*.

A few interspecific hybrids obtained by crossing *Piper attenuatum* with *Piper nigrum* are being characterized. The hybrid possesses intermediate features of the parent species.

Cardamom

In the ongoing screening in the 'Katte' sick plot, 19 natural 'Katte' escapes continue to show field resistance to natural infection of 'Katte' disease.

Ginger

Ginger cultivar 'Wynad local' was superior to all other 14 cultivars evaluated for yield at two locations, Peruvannamuzhi and Moovattupuzha. This cultivar recorded 15.53 kg. and 13.15 kg fresh rhizomes per bed (3 m^2) at Peruvannamuzhi and Moovattupuzha respectively.

Biometrical studies in 100 collections of ginger revealed considerable variability for tiller number and rhizome yield/plant. Plant height, leaf number, tiller number as well as length and width of leaves had positive significant association with rhizome yield/plant. Plant height followed by leaf length had maximum direct effect on rhizome yield/plant. Ginger germplasm accessions 2, 5, 179, 193 and collections 2604, 2624, 3484, 3486, Nadan, Pottangi and Mananthavadi (4x) are promising in terms of fresh rhizome yield and dry recovery.

Turmeric

Seven turmeric lines developed from OP progenies evaluated in replicated trial revealed superiority of a line derived from Moovattupuzha local (25.6 kg/3m^2 bed). However, the progenies did not differ significantly from control (PCT-13 and PCT-14) for yield. A dry recovery of 19.75% was recorded from one of the progenies (C-10). Dry recovery in controls were in the order of 13-14% only.

Tree spices

Identification and labelling 52 elite nutmeg trees were made in private farmers' fields, after a survey of the main nutmeg growing belts of Kerala.

Study of variability and inter-character association for fruit and seed characters in nutmeg revealed maximum variability for fruits/tree, followed by fruit weight.

Progeny analysis of 9 elite cinnamon lines indicated significant variations in the progenies.

Evaluation of cinnamon germplasm lines revealed maximum variability for dry weight of bark, followed by fresh weight. Bark oil and leaf oils were negatively correlated.

HORTICULTURE

Approach grafts of clove are planted in the field. Juvenile allspice cuttings dipped in a commercial rooting hormone gave 50% rooting. Top working of nutmeg by grafting is successful. Orthotropic scions for grafting in nutmeg can be produced by detopping old trees. Further pruning of this orthotropic shoots produced 1-3 orthotropic scions from each of the shoots.

BIOTECHNOLOGY

Micropropagation of *Piper chaba* and *P. longum* were standardized. Shoot tip cul-

tures of endangered species *P. barberi* along with *P. colubrinum* were established.

Callus cultures of *P. longum*, *P. chaba* and *P. colubrinum* were established.

Fifty plantlets were developed from the callus of hybrid Cl.37 x PV 1 by the protocol standardized at NRCS Cardamom Research Centre, Appangala.

In vitro fruit formation was achieved in single flower as well as inflorescence cultures of ginger.

In vitro proliferation of mace (aril of nutmeg) was made possible by culturing fully matured mace on culture medium. This proliferated tissue, not only retained the reddish colour of spice but also retained flavour to some extent. Shoot tip cultures of nutmeg, clove, cinnamon and allspice and callus cultures of cinnamon were established.

EVALUATION OF SPICES FOR QUALITY

Black pepper

Among the 56 germplasm accessions evaluated for quality, accessions rich in essential oil, oleoresin and piperine are CLTP-49 (4.3% oil, 12.2% oleoresin and 4.8% piperine), 56 (4.3% oil, 10.5% oleoresin and 3.4% piperine) and 194 (3.4% oil, 11.6% oleoresin and 4.8% piperine).

Drying pepper on polyethylene sheets (HDPE or LDPE) helps in obtaining clean and dirt free produce in the shortest time.

Cardamom

Among the OP selections No. 871 contained 6.7% oil with 40% 1,8 cineole and 39% α-terpinyl acetate. In the *inter se* selections, Sel. 118 contained 7.3% oil with 41.8% 1,8 cineole and 40% α-terpinyl acetate.

Turmeric

Studies on effect of storage on chemical constituents of turmeric, established that storage of rhizomes after harvest do not significantly affect level of curcumin and oleoresin.

Ginger

Analysis of 86 germplasm accessions for dry recovery, crude fibre, oleoresin, gingerol and shogaol content revealed that dry recovery had significant negative correlation with other constituents while fibre is positively correlated with oleoresin and its constituents.

CHARACTERISATION OF DROUGHT TOLERANCE

Ten plants each of 10 germplasm accessions of pepper are planted for screening for drought tolerance. Field evaluation of pepper varieties KS-69 and Kottanadan are in progress. Enzyme activities viz. nitrate reductase, acid phosphatase and peroxidase under moisture stress are estimated.

NUTRITIONAL REQUIREMENT AND CROP MANAGEMENT

Black pepper

Application of 100 g of N/vine/year recorded the maximum green pepper yield of 1.97 kg/vine during second year of bearing when compared to all other treatments. The main effect of K and the interaction effects were non-significant.

Irrigating pepper vines @ 2 litres/day through drip irrigation from December 1990 to April 1991 recorded the maximum green pepper yield of 2.21 kg/vine during first year of bearing.

Studies on fertilizer requirement of bush pepper showed that bimonthly application of NPK@ 1-0.5-2g/pot of 10kg soil was optimum.

Ammonium polyphosphate was as effective as diammonium orthophosphate as a source of P as measured by availability in the soil, uptake and utilization by pepper berry, content in the leaf, and pepper yield. Soil Zn level was enhanced with application of APP compared to DAP.

Turmeric

Studies on response of improved varieties of turmeric to fertilizers showed that application of NPK@ 60-60-120 Kg/ha was optimum for turmeric. Among the cultivars, maximum response was seen in Sudarshana (40.7 t ha^{-1}) followed by Suguna (30.7 t ha^{-1}).

Ginger

Application of organic cakes significantly increased soil availability uptake of nutrients and increased ginger yield by 12% over fertilizer applied plots.

CROP PROTECTION

Black pepper

Dimethomorph a new anti-oomycetous fungicide was highly sensitive even at 5 ppm *in virto* to *Phytophthora capsici* of black pepper. Among the four metalaxyl formulations viz. Metalaxyl-chlorothalonil, Metalaxyl-copper, Metalaxyl-ziram and Metalaxyl-mancozeb evaluated for comparative efficacy in pot culture, Metalaxyl-ziram and Metalaxyl-mancozeb were superior in disease suppression.

Two bacterial isolates (*Pseudomonas* sp.) showed *in virto* inhibition against *P. capsici* and also showed root rot suppression by *P. capsici* in rooted cuttings of black pepper.

A technique was standardized to induce sporulation in artificially infected black pepper leaves by *P. capsici*. An open pollinated black pepper line P-24 found tolerant to *P. capsici* at initial evaluation in diseased garden at Sirsi, is being evaluated in larger areas along with the local varieties.

A pot culture study with 360 vines inoculated with *Phytophthora capsici* showed significant positive correlation between root rot index and foliar yellowing index.

Inoculation of black pepper vines with VAM fungus *Glomus fasciculatum* prior to inoculation of three major root pathogens viz. *Phytophthora capsici*, *Radopholus similis* and *Meloidogyne incognita* afforded protection by enhancing growth and reducing root loss.

In a pot culture study, inoculation of black pepper cuttings with a nematophagous fungus *Paecilomyces lilacinus* suppressed infestation by *Meloidogyne incognita* and *Radopholus similis*.

In the studies on reproductive biology of 'Pollu' beetle (*Longitarsus nigripennis*), male and female reproductive structures were dissected. Males had a single testis formed by the fusion of four lobes. In females, the ovary composed of five to six ovarioles.

Infestation by top shoot borer (*Cydia hemidoxa*) on 1 year old vines caused significant retardation in growth up to 16,35 and 57% compared to healthy vines when there were one, two and three infestations, respectively during June-December. There was no significant increase in number of branches on infested vines.

Natural enemies of top shoot borer recorded earlier were identified as *Hexamermis* sp. (Nematoda), *Clinotrombium* sp. (Acarina) and *Apanteles cypris* (Hymenoptera); all the

three are new records on the pest. Parasitisation by the entomophagous nematode was as high as 67% during August at Peruvannamuzhi.

Surveys conducted in black pepper areas in Trivandrum and Coorg districts for incidence of scale insects indicated that *Lepidosaphes piperis* was the most important species and 17 and 22.4% of the vines were infested in these districts, respectively. At Salem district (Yercaud) *Aspidiotus destructor* was the most important species and 46% of the vines were infested.

Cardamom

A new virus disease of cardamom which causes typical vein clearing on leaves was identified in Hongadahalla zone, Sakleshpur taluk of Karnataka. Bunchy top, rosetting, hooked tiller and marked stunting are other characteristic symptoms of the virus disease. Experimental transmission of this virus through aphid vector *Pentalonia nigronervosa* f. *caladi* was established.

Soil solarisation of nursery sites for 45 days with transparent polythene sheets (300 guage) during the preceding summer season suppressed soil borne pathogens and weed growth. There was 25.5% increase in germination and the seedlings had better vigour and growth compared to those of non-solarised plots.

Rotylenchulus reniformis was recorded on cardamom roots for the first time.

Application of phorate or carbofuran @ 5 g a.i./clump twice a year was superior to neem oil cake in controlling plant parasitic nematodes and thereby increasing yield of cardamom.

Ginger

Soil solarisation coupled with fungicides treatment reduced soft rot of ginger caused by *Pythium aphanidermatum*. The disease incidence in solarised plots was 23.3% as compared to 48.3% in non-solarised plots. Six lines of ginger arising from the somaclonal variation are tolerant to *Pythium aphanidermatum*.

PRODUCTION OF NUCLEUS PLANTING MATERIALS

Three thousand three hundred and eighty six rooted cuttings of popular high yielding Karimunda and Aimpiriyan cultivars, 903 rooted cuttings of KS-14 and 1487 rooted cuttings of KS-27 are distributed to certified nurseries for establishing nucleus planting material for further multiplication.

One hundred and seventy five kg seed capsules of Cl.37 from the seed plot of NRCS, CRC, Appangala and 680 kg seed capsules of Cl.37 from the Research-cum-demonstration plots were supplied to key development agencies and progressive growers.

TRANSFER OF TECHNOLOGY

Training courses on various aspects of spices production technology were conducted in 9 batches at Calicut. One hundred and thirty five officials from Department of Agriculture and Horticulture from various states attended the courses. Scientists of this centre participated in seminars, symposia and training programmes and attended planters, growers and exporters meetings.

A training on nursery management in spices was arranged for 32 progressive farmers from Kerala, Karnataka and Orissa.

The centre also conducted spices exhibition at RARS, Ambalavayal, Wynad and CPCRI, Kasaragod. A Kisan mela was organised at the Peruvannamuzhi farm, and about 250 farmers attended the mela.

At Appangala, four training courses were conducted on nursery techniques of spices, HPT of cardamom and management aspects of 'Katte' disease. Fifty five trainees took part in these programmes. Scientists participated in seven off-campus growers seminars organised in collaboration with Spices Board.

ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES

All India Coordinated Research Project on Spices has 14 coordinating centres with Calicut as headquarters for coordinating the research conducted on nine spice crops.

Genetic Resources

The AICRP on Spices holds germplasm of nine spices crops. A total number of 311 germplasm of black pepper at Panniyur, Sirsi, and Chintapalli; 352 of small cardamom at Mudigere, Yercaud and Pampadumpara; 34 of large cardamom at Gangtok; 307 of ginger at Solan and Pottangi; 532 of turmeric at Pottangi, Jagtial and Solan; 997 of Coriander, 468 of fenugreek at Coimbatore, Guntur, Jobner and Jagudan; 391 of cumin, 314 of fennel at Jagudan and Jobner are maintained and evaluated.

Crop Improvement

Eleven varieties of spices viz. Aimpiriyan and Ottaplackal-1 in black pepper; CCS-1, PV-1, Mudigere-1, ICRI-1 and ICRI-2 in small cardamom; Surabhi in ginger; Co-3 and Sindhu in coriander and Gujarat cumin-2 in cumin were recommended for release in the XI Workshop/Group meeting of the AICRP on Spices conducted during July 26-28, 1991 at Trivandrum.

A few more promising cultures were identified viz. Cu.1558, Cu.5128, Cu.239 in black pepper at KAU, Panniyur, selections P-3, P-5 and clones Cl-679, Cl-683 and Cl-726 at UAS, Mudigere; PS-10, PV-3, PV-4 and PV-2 at KAU, Pampadumpara and selection APG-7 at TNAU, Yercaud in small cardamom; high yielding mutants V_1E_4-4, V_1S_1-2 and V_2S1-7 in ginger; Ranga and Rasmi and PTS-19 at OUAT, Pottangi and TC-2 in turmeric at TNAU, Coimbatore.

Crop Production

The cardamom clone P-6 showed good degree of drought tolerance. Raised beds (15 cm height) of 1 m. width at convenient length for ginger and 3m x 1 m raised beds for turmeric are standardized.

In turmeric, mother rhizomes of 25-30 g weight are identified the best seed material. Application of higher dose of 140 kg/ha nitrogen alongwith K @ 180 kg/ha and P @ 60 kg/ha gave the highest turmeric rhizome yield. Red gram and French bean appeared to be good intercrops in ginger. Sowing of cumin at 22.5 cm row spacing and at a seed rate of 12 kg/ha is recommeded for maximum yield. Leaf plucking up to 50%, if done 75 days after sowing, did not affect grain yield in coriander.

Crop Protection

Treatment with Bordeaux mixture (1%) and Ridomil MZ WP (100 ppm) were effective in management of foot rot. Leaf diseases in cardamom nurseries are controlled by spraying 0.25 % Dithane M-45. Seed treatment with Bavistin (0.1%) and combination of Dithane M-45(0.25%) and Bavistin (0.1%) followed by Captan (0.25%) for 60 min. increased germination and reduced post emergence rot of ginger.