Dynamics of Agricultural Biotechnology

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CONTENTS

parasitized by the braconid *Allorhogas pallidiceps*. The natural enemies of *Eupterote canaraica* and *E. fabia* include the entomogenous fungus *Beauveria bassiana*. The pseudococcids *Ferrisia virgata* and *Nipaecoccus viridis* and the agromyzid *Tropicomyia* are naturally controlled by different parasitoid species.

970 RAMESH, PK. 1987. **Observations on crop loss in robusta coffee due to mealybug and shot-hole borer**. *Journal of Coffee Research*, 17: 1, 94-95.

The results of studies on losses in robusta coffee due to the pseudococcid *Planococcus spp.* and the scolytid *Xylosandrus compactus* in India in 1984 and 1986 were presented at a workshop on insect pest management strategies in coffee, cardamom and tea cropping systems. The encyrtid *Leptomastix dactylopii* gave effective control of *Planococcus* and the crop loss due to this species varied from 14.38 to 17.08%. The losses due to *X. compactus* were 21.07% on 45-year-old plants and 23.49% on young plants.

971 SRIVASTAVA, LS; VERMA, RN. 1987. **New records of Rhizoctonia blight diseases of coffee and water hyacinth from India**. *Bangladesh Journal of Botany*, 16: 2, 214-215; 2 ref.

R. solani is reported causing much damage to coffee plants in Manipur nurseries and on water hyacinth [*Eichhornia crassipes*]. The possibilities of biological control of the latter weed is discussed.

Papaver somniferum

972 HANSSEN, E BROCHMANN. 1984. **A second pathway for the terminal steps in the biosynthesis of morphine**. *Planta Medica*, 50: 4, 343-345; 21 ref.

[2-3H] Oripavine was administered, using morphinone as a carrier, to mature *Papaver somniferum* plants from Tasmanian and Indian strains, the first of which contained oripavine. Incorporation of oripavine into morphine amounted to 28.1 and 21.4%, respectively. Morphinone generally decomposed during isolation. Thebaine and codeine were not radioactive showing that the 3-O-demethylation of thebaine was not reversible. The results suggest that oripavine represents a step in a secondary pathway from thebaine to morphine.

973 HEBLE, MR. 1985. **Multiple shoot cultures: a viable alternative in vitro system for the production of known and new biologically active plant constituents.** *Primary and secondary metabolism of plant cell cultures*/edited by KH Neumann, W Barz, E Reinhard. Heidelberg, German Federal Republic: Springer-Verlag, p. 281-289; 34 ref.

The initiation and growth of multiple shoot cultures and their production of alkaloids and steroids is reviewed with reference to research on *Dioscorea composita*, *Digitalis*, *Catharanthus roseus*, *Papaver spp.*, *Cinchona spp.*, *Rauwolfia serpentina*, *Chrysanthemum cinerariaefolium* [*Tanacetum cinerariifolium*], *Atropa belladonna* and *Withania somnifera*.

974 KHANNA, KR; SHUKLA, S. 1986. **HPLC investigation of the inheritance of major opium alkaloids**. *Planta Medica*, No. 2: 157-158; 9 ref.

Opium collected from capsules of 2 *Papaver somniferum* lines, *P. setigerum* and their F1 and F2 interspecific hybrids was analysed using high pressure liquid chromatography. Some F1 plants showed heterosis for codeine and thebaine concentration. In some F2 plants concentrations of morphine, thebaine, narcotine and papaverine exceeded the concentrations found in the parents and F1; codeine, however, did not show this effect. Narcotine, which was absent from *P. setigerum*, was absent or present in small amounts in the F1 and F2, suggesting that its absence is almost completely dominant to its presence.

SPICE CROPS

Cuminum cyninum

975 CHATTOPADHYAY, D; SHARMA, AK. 1990. **Chromosome studies and estimation of nuclear DNA in different varieties of *Cuminum cyminum L.* and *Carum copticum Benth* and *Hook***. *Cytologia*, 55: 4, 631-637; 21 ref.

Somatic chromosome number was determined to be 2n=14 in 3 varieties of *C. cyminum* and 2n = 18 in 2 varieties of *C. copticum* [*Trachyspermum ammi*]. Most chromosomes of *C. cyminum* possessed submedian or subterminal constrictions. Karyotype analysis showed gross morphological similarity in *C. cyminum* despite the evolution of different varieties. No marked variations in length and volume of chromosomes were observed among the varieties. Study of DNA content also revealed varietal constancy, with slight variation in the different varieties of *C. cyminum*. A proportionate increase in DNA content was recorded with the increase in chromosomal length and volume in the varieties. A gross homogeneity in chromosome morphology was also found in the 2 varieties of *C. copticum*. The majority of chromosomes possessed either a nearly median or a

nearly sub-median centromere with little size difference in the chromosome complement. Together with minor karyotype differences in 2 varieties, marked variation was found in total chromosome length and volume. However, 4C DNA value between the 2 varieties of *C. copticum* revealed a consistent picture. Differences in chromosome length and volume were attributed to differential spiralization and condensation of chromosomes together with the content of protein and DNA. The constancy in the amount of DNA in different varieties of the same species is a clear index of its selective value.

976 JHA, TB; ROY, SC. 1983. **Morphogenesis and chromosomal analysis in *Cuminum cyminum L.*** *Journal of the Indian Botanical Society*, 62: 2, 181-184; 6 ref.

On basal medium supplemented with 2,4-D, NAA or BA, calluses were produced from hypocotyl and leaf segments of 15-day-old seedlings. Callus plus regenerated shoots, roots and flower buds were all diploid, having 2n = 14 chromosomes. Whole plants were regenerated.

Cardamoms

977 KUMAR, KB; KUMAR, P PRAKASH; BALACHANDRAN, SM; IYER, RD. 1985. **Development of clonal plantlets from immature panicles of cardamom**. *J. of Plantation Crops*, 13: 1, 31-34; 10 ref.

Cultured immature panicles of *Elettaria cardamomum cv. Malabar* formed plantlets directly without the intervention of callus, the floral primordia being converted into vegetative shoots. The stage of development of the explant and the growth regulators in the medium were the main factors influencing the frequency of shoot formation.

978 VARADARASAN, S; KUMARESAN, D. 1987. **The possibilities of integrated management of shoot/capsule borer, *Dichocrocis punctiferalis Guen.* on cardamom**. *J. of Coffee Research*, 17: 1, 135-136.

The integrated control of the pyralid *Dichocrocis punctiferalis*, a pest of cardamom in India, is discussed in a paper presented at a workshop on insect pest management strategies in coffee, cardamom and tea cropping systems held in India in 1986. Chemical control is unsatisfactory because it reaches only the early larval instars, correct timing of pesticide application based on adult emergence is not always possible and *D. punctiferalis* also attacks a number of other crops. The use of light traps, pheromones and hand picking were suggested as possible alternative means of control. The ichneumonid *Friona sp.* is parasitic on larvae of *D. punctiferalis* and is a potential biological control agent.

Zingiber officinale

979 BABU, KN; SAMSUDEEN, K; RATNAMBAL, MJ. 1992. **In vitro plant regeneration from leaf-derived callus in ginger (*Zingiber officinale Rosc.*)**. *Plant Cell, Tissue and Organ Culture*, 29: 2, 71-74; 9 ref.

Excised tissues from young leaves of ginger cv. Maran were cultured on revised MS medium supplemented with various concentrations of growth regulators. The presence of 2,4-D in the culture medium at 9.0-22.6 μM resulted in callus growth. Organogenesis and plantlet formation occurred when the concentration of 2,4-D was reduced to 0.9 μM and with the addition of 44.4 μM benzyladenine into the medium. The rate of plant regeneration increased when the growth regulators were completely removed from the culture medium in the subsequent subcultures. The.

980 BALACHANDRAN, SM; BHAT, SR; CHANDEL, KPS. 1990. **In vitro clonal multiplication of turmeric (*Curcuma spp.*) and ginger (*Zingiber officinale Rosc.*)**. *Plant Cell Reports*, 8: 9, 521-524; 7 ref.

Rhizome buds excised from *C. domestica* [*C. longa*], *C. aeruginosa*, *C. caesia* and ginger were inoculated on MS medium with different combinations of benzyladenine and kinetin. For shoot multiplication, 3.0 mg benzyladenine/litre was found to be optimum for all the species. Rhizome buds of both genera produced shoots and roots simultaneously and within 4 weeks complete plantlets were formed. These were successfully established in the field and were found to be morphologically uniform.

981 KACKAR, A; BHAT, SR; CHANDEL, KPS; MALIK, SK. 1993. **Plant regeneration via somatic embryogenesis in ginger**. *Plant Cell, Tissue and Organ Culture*, 32: 3, 289-292.

982 RAI, MK. 1993. **Identity and taxonomy of hiterhto unreported pathogen causing leaf spot disease of ginger in India**. *Mycotaxon*, 46, 329-333.

Black pepper

983 GEETHA, CK; NAZEEM, PA; JOSEPH, L; SUBHADEVI, PK. 1990. **In vitro callus induction in**

black pepper. *Indian Cocoa, Arecanut and Spices Journal*, 14: 1, 34-36; 1 ref.

Explants of *Piper nigrum cv. Panniyur* 1 (shoot tips, nodal segments, internodal segments and inflorescence, leaf and root segments) were cultured on full and half-strength MS media supplemented with kinetin and NAA. Root and nodal segments only produced callus on full strength medium with 1 p.p.m. kinetin + 3 p.p.m. NAA. Leaf segments only produced callus on half-strength medium with 1 p.p.m. kinetin and 1-3 p.p.m. NAA, with best results using 2 p.p.m. NAA (60% of cultures produced callus).

984 PHILIP, VJ; JOSEPH, D; TRIGGS, GS; DICKINSON, NM. 1993. **Micropropagation of black pepper (*Piper nigrum Linn.*) through shoot tip cultures**. *Plant Cell Reports*, 12: 1, 41-44.

Piper longum

985 BHAT, SR; KACKAR, A; CHANDEL, KPS. 1992. **Plant regeneration from callus cultures of *Piper longum L.* by organogenesis**. *Plant Cell Reports*, 11: 10, 525-528; 10 ref.

Competent callus was initiated around the nodal ring of in vitro grown shoot explants using MS medium supplemented with 1.0 mg NAA and 0.2 mg benzyladenine/-litre. Optimum growth regulator concentrations for shoot induction and shoot elongation were 0.5 mg IAA with 1.5 mg benzyladenine, and 0.1 mg IAA with 0.2 mg benzyladenine/litre, respectively. Elongated shoots were rooted on half-strength MS + 0.1 mg IAA. The rooted plants were successfully established in soil.

986 PRABHU, BR; MULCHANDANI, NW. 1985. **Biosynthesis of piperlongumine**. *Phytochemistry*, 24: 11, 2589-2591; 7 ref.

The incorporation of L[U-14C]lysine and L[U-14C]phenylalanine into piperlongumine was demonstrated in *Piper longum*. The subsequent stepwise degradation to methyl-(3,4,5-trimethoxyphenyl)-propanoate and delta-aminovaleric acid revealed that the C6-C3 moiety of the alkamide arises from phenylalanine; the heterocyclic ring is biosynthesized from lysine. It was shown that DL-[2-14C]tyrosine and [2-14C]sodium acetate are poor precursors of piperlongumine.

Capsicum

987 AGRAWAL, SADHANA; CHANDRA, N; KOTHARI, SL. 1988. **Shoot tip culture of pepper for micropropagation**. *Current Science*, 57: 24, 1347-1349; 8 ref.

Shoot tips from 15-day-old seedlings of *Capsicum annuum var. mathania and Bharat*, a *C. annuum* hybrid, were cultured on MS medium supplemented with kinetin, benzyladenine (BA), IAA, IBA and NAA singly or in various combinations. Shoot buds and rooting were induced in explant callus using high levels of BA or kinetin alone or in combination with IAA or IBA. No loss of morphogenetic potential was noted if callus was regularly subcultured.

988 CHRISTOPHER, T; PROLARAM, B; RAJAM, MV; SUBHASH, K. 1986. **Plantlet formation in embryo cultures of *Capsicum annuum L.* var G4**. *Current Science*, 55: 20, 1036-1037; 9 ref.

When excised mature embryos from surface-sterilized seeds were cultured on Murashige & Skoog (MS) medium supplemented with 0.5-1 mg 2,4-D/litre and 0.5 mg kinetin/litre, callus tissues developed from the green cotyledons. A total of 8-15 roots/embryo developed following transfer of the callus to MS medium supplemented with 1 mg IAA/litre and 0.1 mg kinetin/litre. Complete plantlets were obtained when compacted callus, maintained for >1 month, was transferred to MS medium supplemented with 0.1 mg IAA/litre and 1 mg benzyladenine/litre.

989 HAQUE, E; ALAM, S; AMIN, MN; KABIR, G. 1983. **Karyotype and chiasma frequency in capsicum L.** *Abst. 8th Ann. Bangladesh Sci. Conf.* Dhaka, Bangladesh: p.110.

990 HENDY, H; POCHARD, E; DALMASSO, A. 1985. **Inheritance of resistance to *Meloidogyne chitwood (Tylenchida)* in two lines of *Capsicum annuum L.*: study of homozygous progenies obtained by anther culture**. *Agronomie*, 5: 2, 93-99; 9 ref.

The line PM217, which derives from PI201234 (Central America) and which has resistance to *M. arenaria*, *M. incognita*, *M. javanica* and an unidentified *Meloidogyne* species designated Seville, was crossed with the cultivar Yolo Wonder, which has some resistance to *M. javanica*, as was the line PM687, which derives from PI322719 (India), and which is resistant to *M. arenaria*, *M. incognita* and *M. javanica*. Twenty-five doubled haploids from the cross PM217 X Yolo Wonder and 32 from the cross PM687 X Yolo Wonder were inoculated with 5 populations of the 4 species in pots under controlled conditions in a greenhouse. The results suggested that PM217 has 2 resistance genes, probably independent, designated Me1, controlling resistance to *M.*

arenaria, *M. incognita* and *M. javanica*, and Me2, controlling resistance to *M. javanica* and the unidentified species, and that PM687 has 2 genes, probably linked, designated Me3, controlling resistance to *M. incognita*, *M. javanica* and *M. arenaria* (except for one strain), and Me4, controlling resistance to this one strain of *M. arenaria*. It is suggested that Me1 and Me3, though not allelic, are on the same chromosome. Yolo Wonder had a fifth gene, Me5, controlling its resistance to *M. javanica*.

991 JOHNSON, TS; RAVISHANKAR, GA; VENKATARAMAN, LV. 1990. **In vitro capsaicin production by immobilized cells and placental tissues of *Capsicum annuum L.* grown in liquid medium**. *Plant Science Limerick*, 70: 2, 223-229; 20 ref.

Capsaicin from green *Capsicum* fruits is used as a food additive and in pharmaceuticals. Cell cultures of *C. annuum* (cv. Selection 1) were obtained from seedlings on MS medium supplemented with 2 mg 2,4-D/litre and 0.5 mg kinetin/litre. In vitro-grown cells and placental tissues from fruits were immobilized in calcium alginate. Immobilized cells and placental tissues produced capsaicin which leached out into the medium. Immobilized placental tissue exhibited greater potential for capsaicin synthesis than immobilized cells. Production reached a level of 1345 μg capsaicin/g of immobilized placenta on the 14th day of culture. Production of capsaicin, on replenished nutrient medium, in immobilized placenta, was 2400 μg on the 30th day. Ferulic acid fed to immobilized placenta at 2.5 mM increased capsaicin production 2-fold by the 5th day of the culture period. Of the elicitors used, curdlan was effective on capsaicin production in immobilized cells. Extracts of *Aspergillus niger* and *Rhizopus oligosporus* stimulated capsaicin production in immobilized placental tissues.

992 RAO, NB; VALLI, TS; LAKSHMI, N. 1992. **Cytogenetic studies on the interspecific hybrid *Capsicum baccatum L.* X *C. frutescens L.* and its progeny**. *Euphytica*, 59: 2-3, 135-140; 8 ref.

Morphological and cytogenetical studies were carried out on F1 and F2 hybrids and backcross derivatives from the cross *C. baccatum* X *C. frutescens*. The F1 and F2 hybrids displayed irregular meiosis with a maximum association of eight chromosomes in the former and one quadrivalent in the latter, with the appropriate number of bivalents and univalents. It is inferred that *C. baccatum* differs from *C. frutescens* (yellow) by at least two or three interchanges and from the white cultivar by a single interchange. Structural repatterning of chromosomes, erratic meiotic behaviour, genes for pollen sterility, and segregational imbalances following intergenomic recombination are believed to be major factors causing sterility in the hybrids. The two species are sympatric but natural hybrids have not been found.

993 RAVISHANKAR, GA; SARMA, KS; VENKATARAMAN, LV; KADYAN, AK. 1988. **Effect of nutritional stress on capsaicin production in immobilized cell cultures of *Capsicum annuum***. *Current Science*, 57: 7, 381-383; 11 ref.

Callus was raised from 7-day-old seedlings on MS medium containing 3% sucrose, 2 mg 2,4-D/litre and 0.5 mg kinetin/litre. The cultural procedure, cell immobilization for metabolite production and imposition of nutritional stress are outlined. In the experimental media, nitrates (potassium nitrate and ammonium nitrate), phosphates (potassium dihydrogen orthophosphate) or sucrose were eliminated but all other nutrients and hormones were added as in control. Upon entrapment with sodium alginate there was progressive capsaicin production. Of the 3 experimental media, the one without nitrates showed maximum capsaicin production (a 13-fold increase over the control).

994 SADHANA-AGRAWAL; CHANDRA, N; KOTHARI, SL. 1989. **Plant regeneration in tissue cultures of pepper (*Capsicum annuum L. cv. Mathania*)**. *Plant Cell, Tissue and Organ Culture*, 16: 1, 47-55; 17 ref.

Leaf, stem, hypocotyl, cotyledon, root, shoot tip and embryo explants were cultured on MS medium supplemented with 6-benzylaminopurine ([benzyladenine] BA) or kinetin, alone or in combination with IAA, IBA, NAA or 2,4-D. BA (5 mg/litre) in the medium was best for shoot-bud differentiation. Shoot buds cultured on 5 mg BA/litre increased in number but did not elongate. For obtaining complete plantlets, shoot buds were placed on a medium with IBA or NAA (0.1 mg/litre). Histological evidence revealed direct differentiation of buds from cotyledons. Regenerated plantlets were normal diploids. Unorganized callus could not be induced to differentiate shoot buds.

995 SINHA, PK; DINESH, DS; SAYEED, MZ. 1986. **Influence of *Aneristus ceroplastae Howard* (*Hymenoptera*: *Aphelinidae*) on the population of *Pulvinaria sp. (Homoptera: Coccidae)***. *Entomon*, 11: 2, 81-85; 9 ref.

The influence of the parasite *Aneristus ceroplastae* [*Coccophagus ceroplastae*] on the population of *Pulvinaria sp.* infesting chilli *(Capsicum sp.)* and primrose

(*Mirabilis jalapa*) was investigated in Bihar, India, over a period of one year in 1982-83. There were 7 consecutive generations of the pest during the year. The number of healthy, dead and parasitized individuals was assessed. A rise in the coccid population was found to be closely followed by a rise in the level of parasitism, which brought down the population of the pest to near basal levels within 2-3 weeks. The parasite was not found during late June and July when the pest left the upper exposed part of the host-plant and moved down to escape the intense heat. Parasitism was highest (42.0%) in 2nd-instar nymphs of *Pulvinaria sp.* It is concluded that *Coccophagus ceroplastae* can be considered as a potential biological control agent for *Pulvinaria sp.*

996 SUBHASH, K; CHRISTOPHER, T. 1988. **Direct plantlet formation in cotyledon cultures of *Capsicum frutescens*.** *Current Science*, 57: 2, 99-100; 7 ref.

Callus was induced from root, hypocotyl and cotyledon explants on MS medium supplemented with 2 mg 2,4-D and 1 mg kinetin per litre. Rooting was achieved when the explants were cultured on MS medium with either 0.5 mg NAA + 2 mg kinetin/l or 1 mg NAA + 1 mg kinetin/l. Cotyledon explants showed a low percentage (about 10%) of direct plantlet formation when cultured on MS medium + 1 mg NAA + 1 mg kinetin per litre.

997 SWAMY, TCN. 1983. **Tissue culture multiplication of chillies (*Capsicum annuum L.*) and onion (*Allium cepa L.*).** *Thesis Abstracts*, 9: 4, 340-341.

Regeneration of shoot buds and multiple shoots occurred from cotyledon and shoot-tip explants, respectively, of *C. annuum* cultured on Murashige & Skoog (MS) medium supplemented with various growth regulators of which BA was the most effective for regeneration. IAA, NAA and IBA induced root regeneration from explants. Basal and middle portions of cotyledons produced shoots but cotyledon tips remained quiescent. Plants regenerated on subculturing on MS supplemented with NAA could be transplanted after 6 weeks. It is concluded that the method offers scope for maintaining and propagating male-sterile lines and for cloning *Capsicum* genotypes. For *A. cepa*, callus was induced from radicle tissue cultured on MS supplemented with 6-(3-methyl-2-buten-1-ylamino)-purine (2 mg/litre) and NAA (0.5 mg/litre) after a 3-week dark period.

998 YAZAWA, S; SATO, T; NAMIKI, T. 1989. **Interspecific hybrid dwarfism and geographical distribution of the dwarfness gene in *Capsicum*.** *J. of Japanese Soc. for Hort. Science*, 58: 3, 609-618; 36 ref.

Some cultivars of *C. annuum* show dwarfness in their interspecific hybrids with *C. chinense* No. 3341, manifested as the termination of leaf differentiation after development of several leaves on both main and lateral shoots. Dwarf plants generally maintained their growth characteristics for 2 years. The shoot : root ratio of the dwarf plants was smaller than in normal plants, but root growth of dwarf plants increased to almost normal by grafting normal plants onto dwarf forms. Dwarfness was shown to be controlled by 2 complementary dominant genes, one of which is homozygous in No. 3341. Many old Japanese cultivars and local Korean and Chinese cultivars have another gene and developed dwarfness in hybrids with No. 3341. All cultivars collected from other Asian areas, the subcontinent of India, and North and South America did not possess the dwarf gene complementary to the gene of No. 3341, except for a single cultivar from Guatemala. Results were thought to support the theory that peppers were introduced to Japan from Korea.

Other Spice crops

999 AZAM, M; BISWAS, AK. 1989. **Callus culturing, its maintenance and cytological variations in *Trigonella foenum-graecum L.*** *Current Science*, 58: 15, 844-847; 16 ref.

Cotyledon and hypocotyl explants were cultured on modified MS medium supplemented with NAA, 2,4-D, kinetin and coconut water. Callus tissue formed on cotyledons within 6 days and after 12-15 days with hypocotyl explants. Chromosome number ranged from the normal 2n = 16 to 48 during proliferation of cotyledonary callus. Chromosomal aberrations became more frequent with subsequent subculturing.

1000 CHATTOPADHYAY, D; SHARMA, AK. 1990. **Chromosome studies and microspectrophotometric estimation of nuclear DNA in different strains of *Coriandrum sativum L.*** *Cytobios*, 64: 256, 43-51.

1001 GEORGE, PS; VISVANATH, S; RAVISHANKAR, GA; VENKATARAMAN, LV. 1992. **Tissue culture of saffron (*Crocus sativus L.*): somatic embryogenesis and shoot regeneration.** *Food Biotechnology*, 6: 3, 217-223.

1002 JOSHI, SC; TANDON, P. 1990. **Isolation and maintenance of normal leaf and mite-incited leaf gall tissues of Cinnamomum tamala in culture.** *Indian J. of Experimental Biology*, 28: 9, 838-841; 27 ref.

The isolation and growth factor requirements of gall (caused by an unidentified mite) tissue cultures of

Cinnamomum tamala (cinnamon) were studied. The growth regulators required by gall tissue did not differ fundamentally from those required by healthy tissue. Optimum callusing of explants occurred on medium containing 2,4-D, (10 mg/litre), kinetin (0.1 mg/litre) and beta- mercaptoethanol (1-2 mM). Calluses grew better in medium fortified with 2,4-D (4 mg/litre) and kinetin (0.4 mg/litre). Gall tissue grew faster than healthy tissue. Healthy tissue failed to grow in auxin-free medium, but gall tissue grew poorly after 4-5 passages on medium containing 2,4-D and kinetin. Year-old cultures of both healthy and gall tissues grew on medium devoid of cytokinin for a long time. Addition of caffeic acid and catechol [pyrocatechol] enhanced the growth of both normal and gall tissues, but these phenolics had no effect in the absence of auxin.

1003 KESHAVACHANDRAN, R; KHADER, MA. 1989. **Tissue culture propagation of turmeric**. *South Indian Horticulture*, 37: 2, 101-102; 2 ref.

Bud tissues of the turmeric [*Curcuma longa*] cultivars Co.1 and BSR.1 were cultured on MS medium supplemented with 1 mg kinetin/l, 1 mg BA/l and 40 g sucrose/l. The culturing procedure and explant development are described. After 5 weeks the rooted plantlets were transferred to pots, covered with polyethylene bags and kept under shade. Two weeks later the plants were well established. The average number of shoots produced per bud was 2.11 in BSR.1 and 2.5 in Co. 1.

1004 UNNIKRISHNAN, MC; KUTTAN, R. 1988. **Cytotoxicity of extracts of spices to cultured cells**. *Nutrition and Cancer*, 11: 4, 251-257; 19 ref.

The cytotoxicity of the extracts from 8 different spices used in the Indian diet was determined using Dalton's lymphoma ascites tumour cells and human lymphocytes in vitro and Chinese Hamster Ovary cells and Vero cells in tissue culture. Alcoholic extracts of the spices were more cytotoxic to these cells than their aqueous extracts. Alcoholic extracts of several spices inhibited cell growth at concentrations of 0.2 to 1 mg/ml in vitro and 0.12 to 0.3 mg/ml in tissue culture. Ginger, pippali (dried catkins), pepper and garlic showed the highest activity followed by asafoetida, mustard and horse-gram. These extracts also inhibited thymidine uptake into DNA.

OILSEED PLANTS

Arachis hypogaea

1005 ATREYA, CD; SUBRAHMANYAM, NC. 1989. **Comparative analysis of repetitive DNA in five *Arachis* species**. *Biochemical Systematics and Ecology*, 17: 1, 11-13; 13 ref.

The amount, nature and distribution of repetitive DNA was compared among the 5 species. Repeated DNA varied from 59.0 to 73.5% in the species studied. In the diploid species (*A. regonii* and *A. villosulicarpa*) the amount of highly repetitive DNA was twice as much as in the tetraploid species (*A. hypogaea*, *A. glabrata* and *A. hagenbeckii*). The present comparison suggests that highly repeated DNA elements have been selectively diminished in the tetraploids during speciation in *Arachis*.

1006 ATREYA, CD; RAO, JP; SUBRAHMANYAM, NC. 1984. **In vitro regeneration of peanut (*Arachis hypogaea L.*) plantlets from embryo axes and cotyledon segments**. *Plant Science Letters*, 34: 3, 379-383; 17 ref.

Plantlets were regenerated from embryo axes on Murashige and Skoog (MS), Gamborg B5, potato-extract and Linsmaier and Skoog basal media, MS being best. Plantlets were also regenerated from cotyledon segments on MS supplemented with NAA and/or BA, 1 mg/l NAA inducing the maximum rooting frequency, while 2 mg/l BA induced most shoot formation. Transfer of the shoots to basal MS induced root formation. Combination of 1 mg/l NAA with 0.5-2 mg/l BA in MS resulted in regeneration of whole plants from cotyledon segments, but the regeneration frequency was lower than that with BA alone. Shoot induction was predominantly from the cotyledon segments proximal to the embryo axes.

1007 ATREYA, CD; RAMAKRISHNA, T; PANDIT, MW; SUBRAHMANYAM, NC. 1985. **Molecular approaches to genome analysis in *Arachis* species.** *International workshop on cytogenetics of Arachis: Proceedings*. (Patancheru: 1983: Oct 31 - Nov 2). Central Univ. Hyderabad, Hyderabad, AP 500 134, India. p. 87-92; 17 ref.

DNAs from leaves of *A. hypogaea* (2 cultivars), *A. rigonii*, *A. glabrata* and *A. hagenbeckii* had buoyant densities in caesium chloride which were all within the range 1.6954-1.6962 g/cm3, while the value for *A. villosulicarpa* was distinct (1.6923 g/cm3). Melting temperatures of DNAs were in the range 83.13-85.29°C and their guanine-cytosine contents were 34.1-39.4%, indicating the heterogeneity and relatively high adenine-thymine content of *Arachis* DNA. A comparison of the derived melting curves revealed 4-6 components according to species. Some components were common to all 5 species and others were specific to species or