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A S Chandel and R M Kamal

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CONTENTS

shoot buds was achieved on a variety of auxin-enriched media. Callus growth was stimulated by BA, while IAA at 0.5 and 1 mg/litre stimulated somatic embryogenesis. Concentrations of NH4NO3 (optimum 1650 mg/litre) and sucrose (optimum 4%) in the medium also affected callus growth and embryogenesis.

1994 GOWDA, ANS; NARAYANA, R. 1986. **In vitro studies of spike disease of sandal (*Santalum album L.*)**. *Current Science*, 55: 5, 253-254; 11 ref.

Segments from healthy plants showed callus initiation in 6-8 wk after culture on Murashige & Skoog's or White's basal media supplemented with 2,4-D and benzyl adenine (BA) or kinetin. Spike diseased segments failed to grow on these media unless they were supplemented with gibberellic acid (GA3) in addition to 2,4-D and BA. This difference in response is attributed to the deficiency in the endogenous contents of the spike tissue of growth regulators, particularly GA3. Preliminary trials showed that application of GA3 to diseased sandal plants resulted some degree of recovery.

1995 RAO, PS. 1985. **Plant protoplasts: a new tool in plant biotechnology**. *Current Science*, 54: 7, p. 335-336.

This brief survey deals with work carried out at the author's institution. The use of protoplasts for plant regeneration and/or somatic hybridization in *Santalum album*, *Tylophora indica*, *Arachis hypogaea* and *Physalis spp.* is mentioned.

1996 RAO, PS; BAPAT, VA; MHATRE, M. 1984. **Regulatory factors for in vitro multiplication of sandalwood tree (*Santalum album Linn.*). II. Plant regeneration in nodal and internodal stem explants and occurrence of somaclonal variations in tissue culture raised plants**. *Proceedings of Indian National Science Academy, Part B: Biological Sciences*, 50: 2, 196-202; 25 ref.

Highly variable plantlets were raised following somatic embryogenesis in callus from cultured internodal stem explants. One grew to 210-240 cm in the first year and flowered within 18 months.

Sesbania

1997 SINHA, RK; MALLICK, R. 1991. **Plantlets from somatic callus tissue of the woody legume *Sesbania bispinosa (Jacq.) W.F. Wight***. *Plant Cell Reports*, 10: 5, 247-250; 22 ref.

Callus was established from both cotyledons and mature leaflets on MS basal medium supplemented with BAP [benzyladenine] and 2,4-D (optimum concentrations for callus growth were 0.5 mg and 2 mg/litre, respectively). Callus mediated shoot bud differentiation was studied under defined nutritional, hormonal and cultural conditions. Various concentrations of BAP (0.2-4.0 mg/litre) or kinetin (Kn) (0.5-4.0 mg/litre) with coconut milk (CM) (15% v/v) in MS media induced different levels of shoot bud differentiation as well as multiplication. Multiple shoot bud differentiation occurred in most of the primary calluses. The highest mean number of shoot buds/unit callus tissue (14.33 ± 3.59) was obtained using 2 mg BAP/litre and 15% CM. More efficient shoot bud organogenesis was recorded with BAP than Kn. Supplementation with CM of MS media accelerated shoot bud organogenesis in differentiating callus tissue. Rooting of differentiated shoots was achieved by a 3 step culture procedure involving: (1) MS solid medium containing 2 mg IBA/litre; (2) growth regulator free half-strength MS medium with 1% charcoal; and (3) half strength MS liquid medium free of vitamins, growth regulators and charcoal. Callus mediated successful plant regeneration and multiplication of *S. bispinosa* has not been previously reported.

FEED AND FODDERS

1998 AKHILA, A. 1986. **Biosynthesis of monoterpenes in *Cymbopogon winterianus***. *Phytochemistry*, 25: 2, 421-424; 10 ref.

The isotope ratios of geraniol, citronellol and citronellal biosynthesized in *C. winterianus* from 3H- and 14C-labelled mevalonate indicate that geraniol is converted into citronellol which in turn is converted into citronellal.

1999 AKHILA, A. 1985. **Biosynthetic relationship of citral-trans- and citral-cis in *Cymbopogon flexuosus* (lemongrass)**. *Phytochemistry*, 24:11, 2585-2587; 9 ref.

The use of [14C,3H]-labelled precursors revealed that leaf blades converted geraniol (3,7-dimethylocta-trans-2,6-diene-1-ol) into citral-trans with the loss of pro(1S)-hydrogen whereas nerol lost the pro-(1R) hydrogen while being converted into citral-cis. The citral-trans was converted into citral-cis and vice versa and there was no separate route for the biosynthesis of either of the two aldehyde isomers.

2000 ARYA, ID; ARYA, SARITA; RAO, DV; SHEKHAWAT, NS. 1990. **Variation amongst protoplast-derived moth bean *Vigna aconitifolia* plants**. *Euphytica*, 47: 1, 33-38; 26 ref.

Protoplasts were isolated from leaves of a single plant of this drought resistant species and cultured. Following callus formation 50 entire plants were regenerated and transferred to the field. Only 7 plants survived to maturity and they flowered and produced viable seed. Protoplast-derived plants showed variation in 2 groups of characters. In the first group, protoclones showed variations in seed germination, maturity age, pod length, pod and seed colour, abortive seeds/pod and response to rot diseases. No differences were recorded in pollen stainability and meiotic behaviour. In the second group, analysis of variants showed significance differences for plant height, rachis-length, length and breadth of leaflets, seeds/pod and seed weight.

2001 AYYAPPAN, P; KUMAR, RR. 1989. **Studies on regeneration of *Indigofera teysamanii*.** *Indian Journal of Plant Physiology*, 32: 4, 330-335; 13 ref.

Culture requirements for the in vitro regeneration of *Indigofera teysamanii* [*I. teysmanii*, used as shade trees for plantation crops] from mature and seedling leaf explants were studied using Murashige and Skoog (MS) and Gamborg (B5) media, with added growth regulators (IAA, NAA or 2,4-D at 0.1 p.p.m.; and 2iP, 6-benzyl-aminopurine [benzyladenine] or kinetin at 0.5-5.0 p.p.m.). Callus induction was better in MS medium supplemented with benzyladenine (2.5 p.p.m.) and NAA. Shoot buds were induced on subculturing in medium of the same composition. On culturing in half-strength MS + 2 p.p.m. IBA, the isolated shoots produced roots. The optimum response was under continuous illumination rather than in the dark, and better results were obtained using seedling leaf explants than mature leaf explants. Callus developed on B5 medium, but did not differentiate, regardless of growth regulator addition.

2002 BAJAJ, YPS; GOSAL, SS. 1981. **Regeneration of plants from callus cultures of a forage legume, sweet clover (*Melilotus parviflora Desf.*).** *SABRAO Journal*, 13: 2, 176-179; 10 ref.

Callus cultures raised from young hypocotyl segments of in vitro grown seedlings of 2 cv. of *Melilotus parviflora* were induced to differentiate into complete plantlets. BA was superior to kinetin for the induction of shoot formation. The addition of NAA induced roots on the callus-derived shoots.

2003 BALASUBRAMANYA, RH; BHATAWDEKAR, SP. 1981. **Utilisation of agricultural waste as feed for ruminant**. *Indian J. Microbiol.* 21: 14-16.

2004 BALASUBRAMANYS, RH; PAI, YD; KHANDEPARKAR, VG. 1991. **Production of biogas from solid cellulosic wastes, alternative feedstock for biogas**. *Proceedings of the Workshop*. (1990:29-30 Oct:Khori, Haryana)

2005 BHANWRA, RK; KAUR, N; KAUR, N; GARG, A. 1991. **Embryological studies in some grasses and their taxonomic significance**. *Botanical Journal of the Linnean Society*, 107: 4, 405-419; 22 ref.

Inflorescences of *Lolium multiflorum*, *Rostraria cristata*, *Cenchrus setigerus*, *Digitaria abludens* and *D. ciliaris* at different stages of development were collected from natural populations in Chandigarh, NW India. Microsporogenesis and male gametophyte development were similar in each species except for the number of microsporocytes in a median longitudinal section of each anther lobe. However, members of subfamilies *Pooideae* (*L. multiflorum* and *R. cristata*) and *Panicoideae* (*C. setigerus*, *D. abludens* and *D. ciliaris*) differed markedly in ovary and ovule structure and post-fertilization development. *L. multiflorum* (tribe Poeae) and *R. cristata* (tribe Aveneae) differed in the structure of the dorsal ovary wall, degree of curvature in the megagametophyte in relation to the longitudinal axis of the ovule, and structure of the pericarp. *C. setigerus* is an aposporic apomict and differed markedly from *Digitaria* in the extent of development of the inner integument and in the constitution of the dorsal ovary wall. The 2 species of *Digitaria* showed minor embryological differences.

2006 BHARAL, S; RASHID, A. 1984. **Growth of free-cell suspension and plantlet regeneration in the legume *Indigofera enneaphylla Linn.*** *Biologia Plantarum*, 26: 3, 202-205; 16 ref.

Regeneration of complete plants was achieved from free cell-derived colonies of *I. enneaphylla*. Cell colonies were obtained at a plating density of 2.5 X 103 cells/ml on a medium containing BA, 2,4-D and casein hydrolysate and plantlets were obtained on a medium containing BA. CO2 was essential for the growth of free cells whereas changes in light intensity had no effect.

2007 BHATAWDEKAR, SP; BALASUBRAMANYA, RH. 1983. **Enrichment of cattle feed with microbiol protein**. *Indian J. Microbiol*, 23: 2, 76-80.

2008 CHANDRA, KSJ; SREENATH, HL. 1982. **In vitro culture and morphogenetic studies in some**

species of *Cymbopogon spreng* (aromatic grasses). *Plant tissue culture 1982*, 703-704.

Callus cultures were established from seed, seedling, culm, roots, inflorescence and rhizome explants on Murashige and Skoog medium with 2,4-D. They were especially profuse with *C. flexuosus* (2n = 20, 2n = 40 and 2n = 60 races), *C. nardus* (2n = 20 and 2n = 40 races), *C. winterianus* and *C. martini*. Root induction was achieved with IAA at 1 mg/litre. Plants from seed explants were very variable compared with those obtained from inflorescence explants.

2009 CHELA, GS; TIWANA, MS; THIND, IS; PURI, KP; KAUR, K. 1993. **Effect of bacterial cultures and nitrogen fertility on the yield and quality of maize fodder (*Zea mays L.*).** *Annals of Biology*, 9: 1, 83-86.

2010 DHANALAKSHMI, S; LAKSHMANAN, KK. 1992. **In vitro somatic embryogenesis and plant regeneration in *Clitoria ternatea*.** *Journal of Experimental Botany*, 43: 247, 213-219; 33 ref.

A sustainable in vitro regeneration system using somatic embryos from mature sexual embryos is reported for *C. ternatea*. Somatic embryos developed via callus from seedling roots on hormone-free MS medium (MS1). Addition of growth hormones, KN (kinetin) at 0.5 mg dm-3 (MS2) or KN + IAA at 0.5 mg dm-3 of each (MS3) induced direct somatic embryos, at high frequency, on split root and hypocotyl systems. Embryogenic potential differed with the organ (roots or hypocotyls) and also with the medium. The morphogenetic capacity of the somatic embryos was retained for more than 2 years by subculturing at intervals of 4 weeks on MS3 in complete darkness. Somatic embryos, under the appropriate subculture conditions (16 h light/8 h dark photoperiod at 24 ± 1 °C on media MS3, MS4 and MS5), gave recurrent somatic embryogenesis which was profuse at the shoot and root apices of the somatic embryos. Mature somatic embryos were transplanted to MS1 to stimulate germination and plantlet regeneration. Plantlets, developed from primary and secondary embryos on MS1, were successfully hardened and grown in natural outdoor conditions. The morphology and histology of the somatic embryo and plantlet and the culture conditions for continuous production of plantlets through direct somatic embryogeny are discussed.

2011 GOSAL, SK; GUPTA, RP; GOSAL, SS. 1993. **Induction of somatic embryogenesis and high frequency plantlet regeneration in callus cultures of baggar grass (*Eulaliopsis binata L.*).** *Plant Tissue Culture*, 3: 1, 1-4.

Embryogenic callus cultures were developed in seven clones of baggar grass *(Eulaliopsis binata*). Immature inflorescence segments (0.5-1.0 cm) were aseptically cultured on MS supplemented with 2, 4-D (2-4 mg/l) and Kn (0.5 mg/l). The best callus induction was observed on MS supplemented with 2, 4-D (4 mg/l) + Kn (0.5 mg/l), the range being from 25.9 (BG-1) to 84.8 per cent (BG-10). The length of inflorescence was critical for callus initiation, the optimal size being 1.5 to 2.5 cm. Elevated level of sucrose (6%) induced slow growing but more nodular calli. In subcultures on MS + 2, 4-D (3 mg/l) + Kn (0.5 mg/l), nodular embryogenic regions differentiated on the surface of smooth translucent callus. Following transfer to the basal MS, such nodular calli exhibited a high frequency of regenerants (66.6%) with 14-25 plantlets/culture after four weeks.

2012 GUPTA, BK; SINGH, RV; MEHANDIRATTA, PD. 1983. **Comparative evaluation of varieties of sorghum and Sudangrass for yield and quality of fodder**. *Journal of Research, Punjab Agricultural University*, 20: 3, 319-326; 11 ref.

On the basis of values for green-forage and dry-matter yields, contents of crude protein, neutral and acid-detergent fibre, cellulose, hemicellulose, lignin, tannin and silica, and in vitro digestibility obtained from a trial involving 18 sorghum varieties, a sorghum X Sudan grass hybrid and a Sudan grass control (all values tabulated for each), the sorghums HD2 and PC21 and the hybrid X988 were better than the rest and on a par with the control.

2013 JANARDHANAN, KK; GUPTA, ML; HUSAIN, A. 1990. **Axenic culture of a vesicular-arbuscular mycorrhizal fungus**. *Current Science*, 59: 10, 509-513; 29 ref.

Glomus aggregatum associated with *Cymbopogon martinii var. motia* was cultured and maintained on a synthetic medium. Mycorrhizal association of the isolate was successfully established in callus culture, axenic plants and potted plants. This is the first report of culturing this obligate symbiont.

2014 KACKAR, A; SHEKHAWAT, NS. 1989. **Regeneration of *Lasiurus scindicus* from tissue culture**. *Annals of Botany*, 64: 4, 455-458; 13 ref.

Embryogenic callus was successfully initiated from mature embryos on MS medium supplemented with 6

mg 2,4-D/litre, whereas IAA, NAA and IBA were ineffective. The cultures were maintained on media with 2 mg 2,4-D. Plantlets were regenerated through somatic embryogenesis upon transfer to hormone-free MS basal medium and grew to maturity after planting in soil.

2015 KAMAL, R; MANGLA, M. 1993. **In vivo and in vitro investigations on rotenoids from *Indigofera tinctoria* and their bioefficacy against the larvae of *Anopheles stephensi* and adults of *Callosobruchus chinensis***. *Journal of Biosciences*, 18: 1, 93-101.

2016 LAKSHMANAN, KK; DHANALAKSHMI, S. 1990. **Callus, organogenesis and plantlet formation in tissue cultures of *Clitoria ternatea***. *Annals of Botany*, 66: 4, 451-455.

2017 MANIK, RS; PATIL, RA. 1983. **Feed utilization in relation to feed processing in reminants and non-ruminants.** *Dairy Guid.* 5: 9, 19-22.

2018 MANIK, RS; MEHLA, RK; SRIVASTAVA, A; MUDGAL, VD. 1985. **Influence of season and nature of diet on feed utilization and level of cholesterol**. *Indian J. Anim. Prod. Mgmt.* 1: 4, 160-165.

2019 MANIM, RK; SRIVASTAVA, A; MANIK, RS; MUDGAL, VD. 1986. **A model for recycling of feed nutrients in a crop, animals and bio-gas system in India**. *Agricultural Systems*, 21: 159-169.

2020 MEHLA, RK; SRIVASTAVA, A; MANIK, RS; MUDGAL, VD. 1982. **Recycling of feed energy for productive purposes**. *National Symposium of Recycling of Agricultural and animal by-products for Improving Biological Productivity*. (Karnal: 1982: March 1-3).

2021 MURTY, UR; BHARATHI, M; VISARADA; ANNAPURNA, A. 1992. **Embryogenic callus formation and plant regeneration in *Cenchrus ciliaris (L.)***. *Cereal Research Communications*, 20: 1-2, 7-12; 8 ref.

A schematic diagram is given for the transfer of obligate apomixis from *C. ciliaris* to *Sorghum bicolor* via protoplast fusion. The biotype of *C. ciliaris* examined in this study showed irregular metaphase I and the presence of multiple embryo sacs, indicating the operation of obligate apomixis. Calluses were initiated within 3-4 days from inflorescence explants of 0.5 cm cultured on LS 2.5 medium. Plantlets were regenerated on MS medium containing 5 mg IAA and 0.2 mg kinetin/litre. Many plants survived and grew to maturity in the field and all of these were fertile.

2022 NAQVI, SMK; RAI, AK. 1990. **Effect of nutritional stress on wool yield, characteristics and effeciency of feed conversion to wool**. *Liv. Res. Rur. Dev.* 2: 61-66.

2023 NAQVI, SMK; HOODA, OK. 1990. **Grazing intensity and feeding resources in India**. *Sheep Bull*, 2: 5.

2024 NAQVI, SMK; HOODA, OK. 1990. **Influence of feeding fine level on thermal responses of wool synthetic lambs**. *Second Congress of Asian & Occeanian Physiological Society*. (1990: Nov. 12-15). Central Sheep & Wool Research Institute, Rajasthan, India.

2025 NIGAM, P. 1990. **Mixed culture solid-state fermentation of sugarcane bagasse for feed production**. *Annual Convention of the Sugar Technologists' Association of India: Proceedings*. (Kanpur: 1990). Sugar Technologists' Association of India, Kanpur, India. p. G53-G59; 18 ref.

Solid-state fermentation of powdered sugarcane bagasse + a modified Nokrans' medium (Biotechnology Bioengineering 17, 327) was carried out at 30°C, 99% RH, for 9 days. Microorganisms used were *Trichoderma sp.* (T) and the white-rot basidiomycetes Polyporus strains BH1 and BW1 and *Pleurotus ostreatus* (PO), individually and in combinations of any two of these organisms. Final protein contents in individual cultures of the respective organisms were 4.1%, 18.4%, 21.1% and 18.0%. The low yield with *Trichoderma sp.* was due to its inability to degrade lignin. However, mixed cultures of BH1 + T, BW1 + T and PO + T had final protein contents 24.0%, 27.1% and 25.4%, respectively; corresponding degradations of lignin were 23.1, 20.2 and 19.1%. For production of good-quality animal feed, use of a mixed culture of BW1 + T is recommended.

2026 PANDEY, KC; SINGH, AMAR. 1984. **Laboratory evaluation of medics for resistance to lucerne weevil**. *Indian Journal of Genetics and Plant Breeding*, 44: 2, 253-258; 6 ref.

When 35 *Medicago* genotypes from 7 annual species as well as 5 *M. sativa* entries were screened for resistance to *Hypera postica* in the laboratory, both interspecific and intraspecific differences in leaf damage and larval body-weight gain were significant. The naturally occurring tetraploid (2n = 4x = 32) species *M. scutellata* and *M. rugosa* and the diploid species *M. murex* exhibited greatest antibiosis, followed by *M. truncatula*. The crosses *M. truncatula* X *M. littoralis* and *M. intertexta* X *M. ciliaris* proved compatible whereas *M. scutellata*

and *M. rugosa* were incompatible with each other and with *M. sativa*.

2027 PANDEY, KC; FARUQUI, SA; SINGH, AMAR; PATIL, BD. 1984. **Screening of *Medicago* species for resistance to alfalfa weevil**. *Indian Journal of Agricultural Sciences*, 54: 3, 196-199; 4 ref.

In free-choice and no-choice tests with *Hypera postica* on leaves, leafless stems and stems with leaves of 13 annual *Medicago* species, using the *M. sativa* cultivar Vernal as control, *M. turbinata* was generally the least preferred and *M. turbinata*, *M. intertexta*, *M. truncatula* and *M. scutellata* were resistant. A consistent difference between no-choice and free-choice tests occurred; for example, *M. littoralis* was the second preference of the weevil in free-choice tests but eighth in no-choice tests. Earlier cross compatibility studies revealed that *M. truncatula*, *M. littoralis* and *M. tornata* can be successfully crossed to produce viable hybrids. It is concluded that these species can probably be used in interspecific hybridization.

2028 PANDEY, KC; FARUQUI, SA; SINGH, A. 1984. **Sources of resistance to spotted alfalfa aphid (*Therioaphis maculata Buckton*) in medics**. *Indian J. of Genetics and Plant Breeding*, 44: 1, 1-6; 8 ref.

When 55 lines from 10 annual *Medicago* species together with 5 entries of *M. sativa* were screened for resistance to *Therioaphis maculata* [*T. trifolii* form maculata], *M. rugosa* and *M. scutellata* exhibited maximum antibiosis followed by *M. littoralis*. Hybrids from the crosses *M. truncatula* X *M. littoralis* and *M. intertexta* X *M. ciliaris* (all diploids) showed good fertility and seed set.

2029 SANKHLA, A; DAVIS, TD; SANKHLA, D; SANKHLA, N; UPADHYAYA, A; JOSHI, S. 1992. **Influence of growth regulators on somatic embryogenesis, plantlet regeneration, and post-transplant survival of *Echinochloa frumentacea***. *Plant Cell Reports*, 11: 7, 368-371; 19 ref.

After placement on MS basal medium supplemented with 3-5 mg 2,4-D/litre immature inflorescence explants gave rise to 3 distinct types of callus, a, b and c (loosely arranged and soft, compact and translucent, and compact, sticky and mucilaginous, respectively). Somatic embryo formation occurred in type b callus in about 18-24 d. Callus types a and c did not produce somatic embryos. The highest percentage of cultures with somatic embryos (70%) occurred on the medium containing 5 mg 2,4-D and 0.5 mg kinetin/litre. Somatic embryos also formed directly on the inflorescence (without intervening callus formation) in about 15% of the explants placed on this medium. The addition of 0.25 or 1 mg paclobutrazol or uniconazole/litre to the medium had no influence on the percentage of cultures exhibiting direct somatic embryogenesis, but paclobutrazol slightly increased the mean number of somatic embryos/culture. A total of 95% of the callus-derived somatic embryos germinated when subcultured on basal MS medium supplemented with kinetin. Addition of paclobutrazol or uniconazole decreased somatic embryo germination and shoot elongation but increased root length, leaf width and survival of the plantlets following transplanting to soil. Increased post-transplant survival was accompanied by reduced water loss from the plantlets.

2030 SANKHLA, A; SANKHLA, N. 1989. **Tissue culture studies on desert plants. I. *Cenchrus ciliaris cv. 75***. *Current Science*, 58: 15, 872-874; 4 ref.

Inflorescence segments of cv. 75 were cultured on MS medium supplemented with 1 mg 2,4-D, 5 mg IAA and 0.5 mg kinetin/litre. Callus initiation occurred within 4-6 days and proliferating callus formed by 21 days. All parts of the inflorescence except glumes showed callus proliferation. After 12-14 weeks the callus had numerous green dome-shaped areas from which plantlets regenerated. Up to 60% of plantlets survived to maturity after transfer to soil.

2031 SCHIERE, JB; NELL, AJ; IBRAHIM, MNM. 1988. **Feeding of urea-ammonia treated straw**. *World Animal Review*, No. 65: 31-42; 22 ref.

A treatment system for rice straw used in Sri Lanka is described. 100 kg dry straw are treated with 4 kg urea dissolved in 60-100 litres water and then stored for 7-14 d. Storage can be in a clamp, pit or a covered stack. Two examples are presented to explain the economics of straw feeding and indicate which type of farmer might benefit from this technology.

2032 SEN, JAYANTI; MUKHERJEE, SUMONA; SHARMA, AK. 1990. **Study of chromosomes, DNA amount, and in vitro growth in different species of *Luzula***. *Genome*, 33: 1, 143-147; 13 ref.

Cells of calluses from 6 species showed a differential response in culture with respect to callus growth. Chromosome number variation in vitro, including both hypo- and hyperdiploidy, was recorded in all species except *L. pediformis* and *L. luzuloides*. The chromosome fragments survived as a result of a non- localized centromere. With prolonged culture, normal diploid cells were frequent. Nuclear DNA content of cells of

these species, measured both in vivo and in vitro, ranged from 6.05 to 7.03 pg per 4C nucleus. No marked change in DNA value was noted in cells with high chromosome numbers, thereby confirming their origin through fragmentation of chromosomes. In callus cells, the DNA amount was higher than in normal cells, indicating fragmentation and duplication of individual chromosomes.

2033 SHAILA P; ARATI, AK; BALASUBRAMANYA, RH. 1988. **Bioenriched cottonseed hulls as cattle feed**. *Newsletter, AICOSCA*, 7-9.

2034 TALWAR, MANJUBALA; RASHID, A. 1989. **Somatic embryo formation from unemerged inflorescences and immature embryos of a graminaceous crop *Echinochloa***. *Annals of Bot.*, 64: 2, 195-199.

Formation of somatic embryos of *E. frumentacea* was dependent on the concentrations of specific auxins and mineral nutrients in the culture medium. On N6 medium with a low concentration of 2,4-D somatic embryos were obtained from both immature inflorescences and embryos. Direct differentiation of somatic embryos occurred more frequently in embryos than in inflorescences. On MS medium with different concentrations of 2,4-D compact callus-like masses appeared which regenerated plantlets on auxin-free medium. At higher concentrations of 2,4-D and also on N6 medium compact tissues (morphogenic calluses) made up of thallus-like structures were formed.

2035 TRIPATHI, SN; PATIL, BD. 1984. **Interspecific cross between *Atylosia albicans* and *Atylosia scarabaeoides***. *Current Science*, 53: 14, 755-757; 4 ref.

The single F1 plant obtained from the cross *A. albicans* X *A. scarabaeoides* was semifertile and intermediate between the parents in most characters. It had 10II + 2I at metaphase I and pollen stainability of 53.7%. Some of the F2 plants were fertile, pollen stainability ranging from 30.85% to 93.26%, and varied in the number of univalents at metaphase I. The F2 plants varied considerably in habit.

2036 TYAGI, AK; BHARAL, S; RASHID, A; MAHESHWARI, N. 1985. **Plant regeneration from tissue cultures initiated from immature inflorescences of a grass, *Echinochloa colonum (L.) Link***. *Plant Cell Reports*, 4: 3, 115-117; 30 ref.

Organized structures developed on a white and compact callus initiated from small segments of immature inflorescences of *E. colonum* cultured on MS medium supplemented with 5.0 mg 2,4-D/l and 10% coconut milk. These developed into plantlets upon subculture on to MS medium containing 0 or 0.2 mg 2,4-D/l. The overall success in regenerating plants was about 50%, and 76% of regenerated plantlets grew well on transfer to soil; 11 plants produced seeds.

2037 YABUNO, T. 1985. **A cytogenetical study on a new hexaploid annual species of the genus *Echinochloa* from Sri Lanka**. *Cytologia*, 50: 4, 907-912.

Strain 77-10 (2n = 6x = 54), collected from a rice field at Peradeniya, Sri Lanka, resembles *E. crus-galli* but is distinguished by its convex, coriaceous and lustrous lemma and variegated upper glumes. These characteristics were transmitted as dominant in crosses of 77-10 with the hexaploids *E. colona* and *E. crusgalli* and the tetraploid *E. oryzicola*. On the basis of cytological data from these hybrids, it is suggested that (1) 77-10 should be regarded as a novel species of *Echinochloa* and (2) the 3 hexaploids are distantly related, probably having one genome in common.

AGRICULTURAL WASTES

2038 ARAUJO, A; D'SOUZA, J. 1986. **Enzymatic saccharification of pretreated rice straw and biomass production**. *Biotechnology and Bioengineering*, 28: 10, 1503-1509; 35 ref.

Comparative saccharification of pretreated rice straw using cellulase enzyme produced by *Aspergillus terreus ATCC 52430* and its mutant str. UNGI-40 was studied. The effects of enzyme and substrate concn on the saccharification rate at 24 and 48 h were studied. A higher sugar concn at lower enzyme concn was obtained with the mutant str. The hydrolysate supported the growth of *Candida utilis* and *Saccharomyces cerevisiae ATCC 52431*. A biomass with protein content of 48% was obtained.

2039 BAJPAI, P; SHARMA, A; RAGHURAM, N; BAJPAI, PK. 1989. **Whole cell immobilization for high stability in ethanol production**. *Journal of Microbial Biotechnology*, 4: 2, 87-92; 7 ref.

The main disadvantage of Ca alginate as an immobilization matrix is its disruption via Ca2+ solubilization by certain ions (e.g. Mg2+, K+ and phosphates) and Ca-chelating agents (notably EDTA). A technique is described for hardening and stabilizing such a system for ethanol production. Cells for immobilization were obtained by growing *Saccharomyces cerevisiae* SC 20-2, isolated from sugarcane juice, in a medium containing 50 g [raw?] cane sugar/litre and nutrient salts; they were resuspended in NaCl/Na alginate solution, which