



Journal of
Plant Sciences

ISSN 1816-4951



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Mineral Composition and Genetic Variability of Some Mediterranean Populations of the Cultivated Alfalfa (*Medicago sativa* L.) Supported by Morphological Markers

L. Touil, F. Guesmi, K. Farès, C. Zagrouba and A. Ferchichi

The objective of this study was to investigate the differentiation level among 35 populations in which 20 are locals originating from the Tunisian South and 15 introduced from Italy, Australy, France and Morocco with morphologicals traits and mineral composition. The tenors of sodium, potassium and phosphorus were determined. Diversity according to the mineral composition and morphologicals characters inter populations were analyzed by two statistical procedures, Hierarchical classification and Correspondence Factorial Analysis. Its conclude that the local's populations were adapted at worst conditions in South Tunisian. (*Asian Journal of Plant Sciences* 8 (1): 1-10, 2009; doi: 10.3923/ajps.2009.1.10)

Using Ordination Method for Determination of Effective Environmental Factors on *Astragalus parrawinus* Species Establishment in Semi-Arid Regions of Iran

F. Amiri and A. Saadatfar

The objective of this research was to study using Ordination method for finding the effect of important variables on *Astragalus parrawinus* species quantitative and qualitative changes in Karchambo rangelands of Fereidan Province, Iran. Sampling of soil and vegetation were performed with randomized-systematic method. Vegetation data including density and cover percentage of *Astragalus parrawinus* species were estimated quantitatively within each quadrat and using Ordination method to determination the effective environmental factors on establishment of *Astragalus parrawinus* species. The topographic conditions were recorded in quadrat locations. Soil samples were taken in A (0-30 cm) and B (30-60 cm) depths in each quadrat. The measured soil variables included; texture, saturation moisture (SP), acidity (pH), electrical conductivity (EC), sodium absorption ratio (SAR), C/N ratio, organic matter (%OM) and soluble ions (Na^+ , Ca^{2+} , Mg^{2+} , Cl^-). Multivariate techniques including canonical analysis (CA) was used to analysis the collected data. The results show that there is meaningful correlation between density and cover percentage with soil factors. The results implicate that C/N factor in A horizon and SAR in B horizon have the most effect on *Astragalus parrawinus* density and cover percentage. EC, pH and etc. factors don't have

much effect on *Astragalus parrawinus* species characteristics. (*Asian Journal of Plant Sciences* 8 (1): 11-19, 2009; doi: 10.3923/ajps.2009.11.19)

Screening of Allelopathic Potential Bangladesh Rice Cultivars by Donor-Receiver Bioassay

Md. Abdus Salam and Hisashi Kato-Noguchi

To identify allelopathic rice, 102 Bangladesh rice cultivars (42 high yielding and 60 traditional cultivars) were screen out using laboratory donor-receiver bioassay. Cress (*Lepidium sativum* L.), lettuce (*Lactuca sativa* L.), barnyardgrass (*Echinochloa crus-galli* (L.) Beauv.) and *Echinochloa colonum* (L.) Link were used for bioassay as test plants. High yielding rice cultivars, BRRI dhan37, BRRI dhan30, BR26 and BRRI dhan38, respectively, had the most significant inhibiting effect on the growth of cress, lettuce, barnyardgrass and *E. colonum*. Traditional rice cultivars, Goai and Jogly, respectively, showed the highest inhibition on the growth of cress and lettuce. Kartikshail had the most significant inhibition on the growth of barnyardgrass and *E. colonum*. Although none of the rice cultivar had strong inhibitory activity on all of the test plant species, several rice cultivars inhibited the root and hypocotyl/shoot growth of all the four test plant species and a high yielding rice cultivar, BR17 marked the greatest inhibitory activity with an average of 39.51% of the growth inhibition on roots and hypocotyls/shoots of cress, lettuce, barnyardgrass and *E. colonum*. The present research suggests that BR17 is the most allelopathic in 102 Bangladesh rice cultivars and may be one of the candidates for research programme of Bangladesh rice allelopathy for isolation and identification of allelochemicals. (*Asian Journal of Plant Sciences* 8 (1): 20-27, 2009; doi: 10.3923/ajps.2009.20.27)

Qualitative Evaluation of Land Suitability for Principal Crops in the Gargar Region, Khuzestan Province, Southwest Iran

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Here a land suitability evaluation study for key productions of the region, including wheat, alfalfa, maize and barley, covering an area of 15831 ha was carried out in the region. Using the findings of the semi-detailed soil studies for this area, 2 soil families and 8 soil series in 2 physiographic units was identified. Physiologic requirements of each crop were also determined and rated based upon the proposed methods (Parametric methods and Simple limitation method). Qualitative evaluation was carried out by means of simple limitation and parametric methods

(Storie and Root Square Method) and comparing land and climate characteristics with crop needs. The index obtained for barley, wheat and alfalfa was higher in comparison to that developed for maize. Limiting factors in different crop yield in the region along with climatic variables included soil physical properties, especially its carbonate contents, soil salinity and drainage. From the two methods used i.e., simple limitation and parametric methods (Storie and Square root methods), the latter (Square root methods) produced more realistic results in respect to the existing conditions of the region. (*Asian Journal of Plant Sciences* 8 (1): 28-34, 2009; doi: 10.3923/ajps.2009.28.34)

An Assessment on Bioclimatic Requirements of Endemic *Quercus aucheri* Jaub. et Spach. Communities Spreading South-West Anatolia, Turkey

A. Serteser, M. Kargioğlu, Ç. Şenkul and M. Konuk

This study was carried out to determine of bioclimatic tolerance ranges of *Quercus aucheri* Jaub. et Spach. It is an endemic for Turkey and called as Boz pırnal oak in Turkish. In the determination of bioclimatic appropriateness, the methods of Emberger (Q₂; the humidity category, m; the winter variant) De Martonne (LDS: the length of the dry season) and Gaussen (DSWD: the dry season water deficit) were used. According to Emberger's climagram method used by Quézel and Barbéro, the bioclimatic tolerance range of Boz Pırnal oak is remarkably large as it includes up to 8 different types of Mediterranean bioclimate. Therefore, the bioclimatic niche of the Boz Pırnal oak in Turkey is characterized by highly heterogeneous; cool-humid, cool-subhumid, cool-semiarid, temperate-humid, temperate-subhumid, temperate-semiarid, warm-humid and warm-subhumid. (*Asian Journal of Plant Sciences* 8 (1): 35-41, 2009; doi: 10.3923/ajps.2009.35.41)

Supportive Policies of Greenhouse Organic Cucumber Production in Khorasan-Razavi Province

Mohammad Ghorbani

This study was carried out to study supportive policies of Greenhouse Organic Cucumber (GOC) production in Khorasan-Razavi Province by using a cross sectional data of 60 farmers in 2008. Results showed that farmers want to allocate 64.8% of greenhouse area to organic Cucumber production. 73.3% of farmers believed that Jihad-Agriculture Organization (JAO) has scientific and technical

ability to promote of farmers towards organic agriculture while marketing ability was emphasized only by 33.3% of farmers. Also, 100% of farmers price, 100% insurance, 80% technical-agronomic, 86.7% educational, 86.7% credit, 86.7% market (purchasing of products), 93.3% biological and mechanical control, 86.7% organic fertilizer and 73.3% animal fertilizer as supportive policies presented that government must considered if farmers adopt cucumber organic and movement towards it. Price, insurance, technical-agronomic, educational, credit, market, biological and mechanical, organic fertilizer and animal fertilizer supportive policies have priority one to nine of supportive policies and programs of organic cucumber production in Khorasan-Razavi Province. So, in encouraging programs of farmers to producing of greenhouse organic cucumber must emphasize on this components especially price, insurance, technical-agronomic, educational, credit and market supports for succession the adoption and transition process. (*Asian Journal of Plant Sciences* 8 (1): 42-47, 2009; doi: 10.3923/ajps.2009.42.47)

Additive Main Effects and Multiplicative Interactions Analysis of Grain Yield Performances in Rice Genotypes Across Environments

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Genotype by Environment Interaction (GEI) is a major complications in plant breeding. We used Additive Main Effects and Multiplicative Interaction (AMMI) to evaluate the effects of GEI in NERICA rice genotype and their adaptation in two years at three locations; Ibadan-7°30' N, 3°58' E, 210 m.a.s.l. (Nigeria), Cotonou-6°24' N, 2°19' E, 15.5 m.a.s.l. and Deve-6°48' N, 1°47' E, 72 m.a.s.l. (Benin Republic). Twenty two rice genotypes were grown in 2005 and 2006 under upland condition, using randomized complete block design with three replications. Main effects due to environments (E), genotypes (G) and G×E interaction (GEI) were significant ($p < 0.01$), with the highest variation of 43.1% accounted for by environmental effects. The first four Interaction Principal Component Axes (IPCA1, 2, 3 and 4) were significant ($p < 0.01$) and cumulatively contributed 98.5% of the total GEI. AMMI biplot accounted for 91.4% of the total sum of squares. The stability study indicated that NERICAs 3, 10, 11 and 18 could be considered stable in any of the environments, due to their low interactions. However, NERICA 11 was the most promising of the genotypes, with high yield (5.15 t ha^{-1}) and a broad environmental adaptation. (*Asian Journal of Plant Sciences* 8 (1): 48-53, 2009; doi: 10.3923/ajps.2009.48.53)

Studies on Presence and Response of *Agrobacterium rol* Genes in Three Varieties of Tobacco

P. Vijay Joshua, D.R. Salomi Suneetha, A. Arundhati and G. Seshagiri Rao

Present study was undertaken to identify the presence of *rol* genes of *Agrobacterium rhizogenes* in *Nicotiana tabacum* var. Samsun, *N. undulata* and *N. tabacum* var. Xanthi and their response towards hormonal shifts in culture. These three species of *Nicotiana* appear normal under field conditions and the leaf discs produced shoots on cytokinin containing Murashige and Skoog medium. These shoots when shifted to MS basal medium, *N. tabacum* var. Samsun showed rooty morphogenesis and the growth of the shoots continued for *N. undulata* but the growth stopped and the discs turned brown in *N. tabacum* var. Xanthi. Similar results with rooty morphogenesis were observed on MS supplemented with auxin medium. Genomic DNA of these three *Nicotiana* species when used for PCR analysis with *rol A, B, C* and *D* gene primers of *A. rhizogenes*, *N. tabacum* var. Samsun showed amplification of *rol A, B, C* and *D* genes, *N. undulata* showed amplification of *rol A* and *C* genes and no specific amplification was observed for *N. tabacum* var. Xanthi. The results were discussed in terms of the correlation between the presence of different combination of *rol* genes in *N. tabacum* var. Samsun and *N. undulata* and their response for habituation on hormone free medium with differential morphogenesis on hormonal shifts. (*Asian Journal of Plant Sciences* 8 (1): 54-58, 2009; doi: 10.3923/ajps.2009.54.58)

Foliar Sesquiterpene Variations in Natural Populations of *Cupressus dupreziana* in Tassili N'Ajjer (Algeria)

M. Ramdani and T. Lograda

Cupressus dupreziana A. Camus (Cupressaceae) is an endemic species in the Tassili n'Ajjer (Algerian Central Sahara). Terpenoid analysis were carried out on 160 trees of 12 natural populations with a view to determining the intra-specific variability. Eighteen sesquiterpenes were detected, including germacrene-D, which was found to be particularly abundant. The terpenoid markers used made it possible to determine the individual patterns of chemotypic variability. The variability of the sesquiterpene composition confirms that genetic factors were not responsible for the decrease in the numbers of this species. The main reason for this decrease is probably the desertification of the Tassili n'Ajjer. (*Asian Journal of Plant Sciences* 8 (1): 59-63, 2009; doi: 10.3923/ajps.2009.59.63)

Comparing the Agronomic and Grain Quality Characteristics of Transgenic Rice Lines Expressing *cry1Ab* vs. Non-Transgenic Controls

G. Kiani, G.A. Nematzadeh, B. Ghareyazie and M. Sattari

This study aimed to investigate and compare the agronomic and grain quality attributes of three advanced backcross-derived transgenic rice lines expressing synthetic *cry1Ab* gene vs. non-transgenic control in a Randomized Complete Block Design (RCBD) under field conditions. The data exhibited that transgenic rice lines, Neda and Nemat were higher in height, earlier in maturity and highly resistant to striped stem borer (*Chilo suppressalis*) in comparing with non-transgenic varieties. In contrast, no significant difference was observed for transgenic Khazar as compared to its control, except for 1000-grain weight. Laboratory tests for grain physicochemical properties showed no significant variations between transgenic lines and non-transgenic controls. However, some variations for traits like Amylose Content (AC) and Gel Consistency (GC) were seen for transgenic Neda and Khazar, respectively. As regards the rice striped stem borer natural infestation, field-release experiment indicated that all three transgenic rice lines conferred a very high degree of resistance to rice striped stem borer as compared to non-transgenic check varieties. (*Asian Journal of Plant Sciences* 8 (1): 64-68, 2009; doi: 10.3923/ajps.2009.64.68)

Factors Influencing on Minimum Offer Price of Farmers for Producing Greenhouse Organic Cucumber in Khorasan Razavi Province

M. Ghorbani

This study examined factors influencing on minimum offer price of farmers for producing greenhouse organic cucumber in Khorasan Razavi Province by using linear regression and cross sectional data of 60 greenhouse cucumber producers in 2008. Results showed that 80% of farmers believed price of organic products must be 10% more than conventional products. Minimum offer price of organic cucumber is 6348.6 rial kg⁻¹. Also, relationship between age, of farmers, cucumber insurance, average current yield of conventional cucumber, information about organic cucumber, cultivated area that allocate to organic cucumber and minimum offer price for producing greenhouse organic cucumber is positive. Relationship between farmer's job, using of agricultural advisory, agricultural experience, organic market information, participation in extension classes and minimum offer price of greenhouse organic cucumber is negative. Regard to

results, creating organic products market information systems, extension and education of organic cucumber, more activate of agricultural advisory, balancing expansion of organic cucumber cultivated area and conduct of insurance toward effectiveness on decreasing of risk and increasing of production suggested. (*Asian Journal of Plant Sciences* 8 (1): 69-73, 2009; **doi**: 10.3923/ajps.2009.69.73)

Effect of Irrigation Regimes on Grain Growth Indices of Three Winter Wheat (*Triticum aestivum* L.) Cultivars Under the Iranian Conditions

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An experiment was conducted during 2004-2006 at the Agricultural Research Station, Islamic Azad University, Khorasgan Branch, Isfahan, Iran. The purpose of this study is to study the effect of deficit irrigation regimes on the grain growth rate and the effective grain filling period of the bread wheat (*Triticum aestivum* L.) cultivars. A split plot layout arranged in randomized complete block design with four replications was used. Irrigation regimes (irrigation after 70 mm (I₁), 90 mm (I₂) and 110 mm (I₃) cumulative evaporation from class A evaporation pan) were considered as the main plot and three wheat cultivars (Mahdavy, Ghods and Roshan-Backcross) as subplots. The I₁ and I₂ did not differ significantly for grain growth rate (GGR) and effective grain filling period (EGFP). Delay in irrigation from the I₂ to the I₃ caused significant reduction in grain growth rate and effective grain filling period. Trend of changes in grain weight was similar in the I₁ and the I₂. In all samplings, delay in irrigation from the I₂ to the I₃ reduced grain weight. Cultivars differed significantly in respect to grain growth. The effect of grain growth rate on 1000-grain weight was more pronounced than effective grain filling period. Obtained results indicate that irrigation after 90 mm cumulative evaporation from class (A) evaporation pan might be suitable for the grain weight of winter wheat under similar the conditions to this experiment where irrigation water during grain filling period is not abundant. (*Asian Journal of Plant Sciences* 8 (1): 74-77, 2009; **doi**: 10.3923/ajps.2009.74.77)

Agronomic Performance of Intercropped Wheat Cultivars

A. Biabani

A field study was carried out to assess whether intercropping of three commonly used cultivars of wheat in Iran with different height may increase seed yield. Seed yield three wheat cultivars which differed in were investigated at educational field

of Gonbad Agricultural Faculty in 2005-2006 (Iran). The statistical design was factorial 3 plant densities of 300, 350 and 400 seed in m² with 6 intercropping ratios of Kohdasht, Tajan and Zagros (3 pure stand and 3 50:50 intercropping of Kohdasht, Tajan and Zagros cultivars, respectively) in completely randomized blocks. The results showed that none of the treatments has no significant effect on yield. The results indicated that the highest seed yield was obtained from 50:50 ratios of Tajan-Zagros cultivars in density plant 400 of seed in m² which had Land Equivalent Ratio (LER) above 1.25. Calculation of LER revealed that seed yield in treatment TZTZT was 25% higher than the pure stand. Intercropping ratio showed no significant effect on any of yield components. (*Asian Journal of Plant Sciences* 8 (1): 78-81, 2009; doi: 10.3923/ajps.2009.78.81)

Gene Action for Resistance to Sunn Pest (*Eurygaster integriceps* Put.) in Bread Wheat

F. Fatehi, M.R. Behamta and A.A. Zali

Sunn pest *Eurygaster integriceps* Put. (Heteroptera: Scutelleridae) is well known as a serious limiting factor for production of wheat grain with strong gluten in the wide area of the Near and Middle East, Eastern and South Europe and North Africa. To study the genetics of resistance to sunn pest in bread wheat, two susceptible (Falat and Line 14) and a resistant (Line 30) lines were crossed to each other as follow: Line 14/Line 30 and Falat/Line 30. The six basic generations (parent cultivars (P1, P2), first and second filial generations (F1, F2), first and second backcrosses (BC1, BC2)) of crossings were planted in a randomized block design in three replicate plots. In early seed development stage, six sunn pest (nymph3) were introduced in each cage having a wheat plant. after 40 days percent damaged seed along with their genetic characteristics were assessed through generation mean analysis method. Gene effects including mean effect, additive, dominance, epistasis effects of additive×additive, additive×dominance and dominance×dominance were observed. The broad sense heritability for the Line 14/Line 30 cross and the Falat/Line 30 cross were estimated 0.78 and 0.84 while narrow sense heritability were 0.51 and 0.67, respectively. (*Asian Journal of Plant Sciences* 8 (1): 82-85, 2009; doi: 10.3923/ajps.2009.82.85)

An Internal Structure Investigation on *Euphorbia* L. Species in North-East of Iran

A. Jafari and Y. Nasseh

In present research anatomical studies carried out 11 species which growing in Khorassan Province (North-East of Iran). These species were divided to two

groups, annual and perennial species. For comparative anatomy studying, cross sections from stem and leaf were prepared using microtome and differential staining. The characters of secondary xylem and axial parenchyma, arrangement of vessel and the arrangement of mesophyll were studied. The results showed the variation of internal structure didn't have correspondence to taxonomy position. (*Asian Journal of Plant Sciences* 8 (1): 86-88, 2009; doi: 10.3923/ajps.2009.86.88)

Effect of Cutting Time and Cutting Height on Yield and Yield Components of Ratoon Rice (Tarom Langrodi Variety)

M.S. Daliri, A. Eftekhari, H.R. Mobasser, D.B. Tari and H. Porkalhor

In order to study the effect of cutting time and cutting height on yield and yield components of ratoon rice (*Oryza sativa* L.) Tarom langrody variety a field experiment was carried out in the field of Ghaemshahr Azad University in 2007. Experimental design was arranged in spilt plot in basis of Randomized Completely Block Design with four replications. Some agronomical traits such as numbers of effective tiller hill⁻¹, panicle number m⁻², total spikelet panicle⁻¹, filled spikelets percentage, 1000 grains weight, grain and biological yield and harvest index were measured. Results showed that the effect of cutting time on number of effective tiller hill⁻¹, panicle m⁻², percent filled spikelet panicle⁻¹, grain yield and harvest index were found statistically significant. Cutting height had a significant effect on number of tiller in hill, number of effective tiller in hill, number of panicle m⁻², filled spikelet panicle⁻¹ percentage, grain yield and harvest index. Interaction among cutting time and cutting height on number of tiller hill⁻¹, number of effective tillers hill⁻¹, number of panicle m⁻² percent filled spikelet panicle⁻¹ were significant. According to results cutting time at physiological maturity and also cutting in 40 cm cutting height from soil surface for the best grain yield of ratoon rice were recommended. (*Asian Journal of Plant Sciences* 8 (1): 89-91, 2009; doi: 10.3923/ajps.2009.89.91)

Characterization of the Climatic Rankins for Jamaica (*Hibiscus sabdariffa* L.) Crop in Jalisco, México

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The present research contains the geographical references detailed by municipal including climatic characteristics, marginal areas, optimal and suboptimal areas

where Jamaica as an alternative crop represents a viable option for the maintainable development of those regions with climatic limitations for other crops. Based on the reference data it is considered 125 humidity days as the optimal to develop the crop. In Jalisco 900,000 ha has been reported with this condition within the nine climatic zones existing. (*Asian Journal of Plant Sciences* 8 (2): 92-101, 2009; *doi*: 10.3923/ajps.2009.92.101)

Stability of Relationship Between Chlorophyll Density and Soil Plant Analysis Development Chlorophyll Meter Readings in Peanut Across Different Drought Stress Conditions

A. Arunyanark, S. Jogloy, N. Vorasoot, C. Akkasaeng, T. Kesmala and A. Patanothai

The objectives of this study were to examine the stability of SPAD (soil plant analysis development) chlorophyll meter reading (SCMR) and chlorophyll density, surrogate trait of drought tolerance in peanut (*Arachis hypogaea* L.) and their relationships in different leaf positions at different times under different drought stress conditions. Chlorophyll density and SCMR varied depending on water regimes, times of sampling and genotypes, but water regime \times genotype interactions were not significant for chlorophyll density and SCMR. The correlation coefficients between chlorophyll density and SCMR were positive and significant across irrigation treatments ($r = 0.76^{**}$, 0.94^{**} and 0.96^{**}) and each water regime, plant age and leaf position ($r = 0.31$ to 0.99^{**}). Interestingly, chlorophyll density and SCMR at different water regimes were also correlated significantly, indicating the stability of their relationship in different water regime conditions. The result suggest that evaluation of chlorophyll density by SCMR can be carried out at any water regime conditions in the second or third-fully expanded leaves after 40 days of crop growth. This confers a large flexibility to application of SCMR in breeding program for drought tolerance. (*Asian Journal of Plant Sciences* 8 (2): 102-110, 2009; *doi*: 10.3923/ajps.2009.102.110)

Genetic Diversity among Barley Populations from West China Based on RAMP and RAPD Markers

Z.E. Pu, Y.C. Hou, X.X. Xu, Z.H. Yan, Y.M. Wei, X.J. Lan and Y.L. Zheng

Using RAMP and RAPD for detecting the genetic diversity of 46 barley accessions, collected from west China. Seventeen primer combinations produced 104 discernible RAMP fragments of which 96 (91%) were polymorphic. The

number of fragments per primer combination varied from 2 to 11, with the mean of 6.18. The mean of Polymorphism Information Content (PIC) for the RAMPs was 0.752. On the basis of 96 polymorphic fragments, each genotype had a unique banding profile and the Genetic Similarity (GS) coefficient varied between 0.450 and 0.960, with the mean of 0.803. In RAPD analysis, 28 out of 43 bands (65%) were polymorphic. The number of alleles ranged from 1 to 8, with an average of 2.53 per primer. The mean of Polymorphism Information Content (PIC) for the RAPDs was 0.282. The Genetic Similarity (GS) coefficient varied between 0.679 and 1.000, with the mean of 0.898. The mean values of GS within the HS, HA and HV groups were 0.909, 0.893 and 0.913, respectively. RAMP-based genetic similarity matrices were compared with the corresponding RAPD-based matrices by the Mantel test. A poor of correlation was found between both sets of data, indicating little relationship between these two estimators of genetic similarity. The cluster results based on RAMP more faithfully distinguished the experimental accessions than did the RAPD results. Both dendrograms generated by the RAPD matrix and the RAMP matrix all agree better with the groups of the genotypes, but the dendrogram generated by the RAPD matrix agrees better with the geographic origins of the genotypes than the dendrogram generated by the RAMP results. (*Asian Journal of Plant Sciences* 8 (2): 111-119, 2009; *doi*: 10.3923/ajps.2009.111.119)

Identification of Traits Related to Drought Resistance in Peanut (*Arachis hypogaea* L.)

M. Painawadee, S. Jogloy, T. Kesmala, C. Akkasaeng and A. Patanothai

The aim of this study was to investigate whether some root characters and physiological characters are related to drought resistance in some elite germplasm lines earlier identified as drought resistant based on pod yield. Four peanut genotypes were tested in a pot experiment under two soil moisture levels [Field Capacity (FC) and 1/3 available water (1/3 AW)]. A 2×4 factorial experiment was laid out in RCBD with six replications. Data were recorded for Relative Water Content (RWC), Specific Leaf Area (SLA), SPAD Chlorophyll Meter Reading (SCMR), root and biomass at 70 days after planting. Root characters, biomass production, pod yield and Harvest Index (HI) were recorded at harvest and Drought Tolerance Index (DTI) for these traits were also calculated. Differences between water treatments were also significant for RWC, SLA, Root Dry Weight (RDW) and biomass but not significant for SCMR, harvest index and pod yield. Drought stress reduced RWC, SLA, RDW and biomass but had no

significant effect on SCMR, harvest index and pod yield. Significant differences among peanut genotypes were found for SLA at both water treatments. ICGV 98353 had the lowest SLA at both water treatments. Peanut genotypes were significantly different for RDW and RWC at 1/3 AW only. KK 4 had the highest RDW. ICGV 98324 performed best for RWC and it also had the highest DTI for RWC. ICGV 98324 also had the highest SCMR, which was significantly different among peanut genotypes at FC. (*Asian Journal of Plant Sciences* 8 (2): 120-128, 2009; *doi*: 10.3923/ajps.2009.120.128)

Pollen Micromorphological Studies of the Genus *Chenopodium* (Chenopodiaceae) in Iran

S.M.M. Hamdi, M. Malekloo, M. Assadi and T. Nejadstari

The main purpose of this study is to analyze palynomorphological characters among the member of this genus and evaluating the efficiency of these features in systematics of the genus. Pollen of 14 species belonging to genus *Chenopodium* was studied by Scanning Electron Microscope (SEM). All studied species have pollens with, spheroidal shape, radial symmetrical, isopolar and peripolporate. The exine surface ornamentation is scabrate. All studied species haven indicating that there are two pore types on pollen surface: foveat and perforate. The results of this studies show that pollen micromorphology can be considered used to superstation between species this genus. (*Asian Journal of Plant Sciences* 8 (2): 129-137, 2009; *doi*: 10.3923/ajps.2009.129.137)

Response to Early Drought for Traits Related to Nitrogen Fixation and Their Correlation to Yield and Drought Tolerance Traits in Peanut (*Arachis hypogaea* L.)

H. Wunna, S. Jogloy, B. Toomsan and J. Sanitchon

This study was aimed to examine the response and contribution of early drought to traits related to N₂-fixation and pod yield and their correlation to drought tolerance. The experiment was conducted at the Field Crop Research Station of Khon Kaen University, Khon Kaen Province, Thailand in the dry season of 2007/08. Eleven peanut genotypes (ICGV 98300, ICGV 98303, ICGV 98305, ICGV 98308, ICGV 98324, KK 60-3, Tainan 9, KKU 72-1, KKU 60, KK 4 and KKU 1) and two soil moisture levels [field capacity (FC) and 1/3 available water (1/3 AW)] were laid out in a split-plot design with four replications. Early

drought treatment was given by maintaining 1/3 AW from emergence to 40 days after emergence followed by adequate water supply. The data were recorded for nodule dry weight (NDW) and biomass production (BM) as traits related to N₂-fixation (TNf) at harvest. In addition to, the data on pod yield, number of pod plant⁻¹, number of seed pod⁻¹ and seed size (SZ) were also collected at harvest. Specific leaf area (SLA) and SPAD chlorophyll meter reading (SCMR) were measured on 20, 40, 50 and 60 days after emergence (DAE) as drought tolerance traits and harvest index (HI) was calculated after harvest. Early drought did not affect NDW and BM. Major variation was found among peanut genotypes and ICGV 98305 showed higher NDW and pod yield under drought condition. Significant and consistent correlation was found between NDW and BM, ($r = 0.82^*$, $p < 0.05$) and ($r = 80^*$, $p < 0.05$) under FC and 1/3 AW, respectively. The correlation between TNf and pod yield and yield component parameters varied under the two water regimes. Under 1/3 AW, the only positive correlation observed was between SZ and BM and it might be the only reason for increase in pod yield in some genotypes. SCMR at 60 DAE was strongly related with TNf under both water regimes. There was not any correlation between SLA and HI with NDW and BM. SCMR at 60 DAE is useful to detect chlorophyll density and N₂-fixation under both water regimes because of its high and constant correlation with Tnf. (*Asian Journal of Plant Sciences* 8 (2): 138-145, 2009; doi: 10.3923/ajps.2009.138.145)

Molecular Analysis of Genetic Stability in Long-Term Micropropagated Shoots of *Olea europaea* L. (cv. Dezful)

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Somaclonal variation of Micropropagated plants of olive trees (cv. Dezful) were evaluated between subcultures as well as two different carbohydrate sources by using RAPD technique and physiological characters. In this study, the highest polymorphic RAPD bands were observed between regenerated plants of first subculture and seventh subculture's while, the lowest changes were shown between two carbohydrate treatments in each subculture and it was also true between mother trees and first subculture plants. Different subcultures produced different level of genetic diversity in the cultivar studied. The genotypes also differed significantly in physiological characters like number of nods and branches by increasing the number of subcultures. The data reported in this study revealed

that micropropagation may affect both genetic profile and physiological traits of the olive plants studied. (*Asian Journal of Plant Sciences* 8 (2): 146-152, 2009; doi: 10.3923/ajps.2009.146.152)

Stimulation of Nematode-Destroying Fungi by Organic Amendments Applied in Management of Plant Parasitic Nematode

P.M. Wachira, J.W. Kimenju, S.A. Okoth and R.K. Mibey

A screenhouse experiment was conducted to evaluate the effect of cow manure, chicken manure and their combinations on nematode destroying fungi, nematode community and growth of tomato (*Solanum lycopersicum* L.). The amendments were applied at the rate of 5% w/w in all the treatments. Isolation of nematode destroying fungi was done using the soil sprinkle technique. Nematodes were extracted from soil using the modified Baermann technique. Tomato growth was estimated through plant height and dry weight. Application of the organic amendments resulted in significant differences ($p \leq 0.05$) in occurrence of nematode destroying fungi amongst the treatments. The nematode destroying fungi occurred at frequencies of 50, 29.4, 17.6 and 2.9% in soil amended with chicken manure, cow/chicken combination, cow manures and the control, respectively. Eight species of nematode destroying fungi were identified in this study. The fungus *Arthrobotrys oligospora* (Fresenius) was most dominant fungus in all the treatments including control pots with an isolation frequency of 38.2%. Addition of organic amendments into the soil also resulted in an increase of bacterial and fungal feeding nematodes and reduction of plant parasitic nematodes. Specifically there was a 225, 96 and 62% increase in bacterial feeding nematodes and 391, 96 and 74% increase in fungal feeding nematodes in soil amended with chicken manure alone, combination of chicken and cow manure alone in that order. Numbers of plant-parasitic nematodes were 92% lower in soil treated with chicken manure compared to the control. Plant height and leaf widths were highest in plants treated with combination of cow and chicken manures. The plants mean dry weight were 6.6, 5.6, 2.0 and 1.5 in combination of chicken and cow manure, chicken manure alone, cow manure alone and control, respectively. This study has therefore, revealed that organic amendments stimulate the occurrence of nematode destroying fungi in the soil and also reduce plant parasitic nematodes. In addition, the combination of cow and chicken manure stimulates plant growth. (*Asian Journal of Plant Sciences* 8 (2): 153-159, 2009; doi: 10.3923/ajps.2009.153.159)

Effects of Nitrogen Fertilizing Systems and Harvest Frequencies on Forage Dry Matter Yield and Quality of Snail Medic (*Medicago scutellata* Var. Robinson)

A.H.A. Ahmadi, M.R. Chaichi and M. Mirabzade

The study was conducted to determine the effects of nitrogen fertilizing systems and harvest frequencies on DM (dry matter) yield and forage quality of snail medic; *Medicago scutellata* var. Robinson. *Rhizobium meliloti* inoculation and four levels of chemical nitrogen fertilizer (0, 25, 75 and 125 kg N ha⁻¹) were allocated to the main plots while four levels of harvest frequencies such as 1, 2 and 3 weeks intervals and control with only one harvest at 50% flowering were assigned to subplots. According to the results of this experiment, nitrogen fertilizing systems had significant effects ($p < 0.05$) on DM yield and CP (crude protein) concentration of snail medic as these traits increased with the increment in availability of nitrogen for plants. Harvest frequency increased the DM yield, CP and WSC (water soluble carbohydrate) concentrations, whereas decreased the ADF (acid detergent fiber) concentration. Interaction between harvest frequency and nitrogen fertilizer systems was significant ($p < 0.05$) for DM yield and WSC concentration; hence treatment of 75 kg N ha⁻¹ with two-week harvest interval produced acceptable DM yield with proper quality in *M. scutellata*, which eliminated the necessity of *Rhizobium* inoculation and reduced the cost and environmental contamination compared to 125 kg N ha⁻¹. (*Asian Journal of Plant Sciences* 8 (2): 160-165, 2009; **doi**: 10.3923/ajps.2009.160.165)

Incidence of Aphid-Transmitted Viruses in Farmer-Based Seed Potato Production in Kenya

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Field studies were carried out in farmer-based seed potato production to determine the incidence of potato aphids and potato aphid-transmitted viruses in two potato-producing areas of Kenya. Parameters determined included aphid population, virus disease incidence and tuber yield. Aphid population was monitored on leaves and in water-pan traps. Virus infection was determined based on symptoms and the viruses were identified in tubers sprouts by DAS-ELISA. Tuber yield was determined for plants showing virus symptoms and healthy-looking plants. Five aphid species were identified, with the most abundant being *M. euphorbiae* and *A. gossypii* on leaves and *M. persicae* and *A. gossypii* in water traps. The average aphid population was between 1.4 and 4.2 aphids per

three leaves and 4.68 and 9.64 aphids per water pan trap. Farms with higher population of *M. persicae* had higher virus disease incidence. The most prevalent viruses were PVS, PLRV and PVM. Healthy looking plants had a latent infection rate 57.2% compared to 76.6% for symptomatic plants. Virus infection reduced the number and weight of tubers by 74 and 62.7%, respectively. However, virus infection increased the number and weight of the chats grade. The results indicated that aphid infestation and virus disease incidence were higher than the recommended for seed potato production. Therefore, there is need to create awareness among the farmers on aphid and virus symptom recognition and use of clean certified seed potato. (*Asian Journal of Plant Sciences* 8 (2): 166-171, 2009; doi: 10.3923/ajps.2009.166.171)

***In vitro* Antibacterial Properties of Total Alkaloids Extract from *Mitragyna Inermis* (Willd.) O. Kuntze, a West African Traditional Medicinal Plant**

C. Zongo, Etienne-François O. Akomo, A. Savadogo, Louis Clement Obame, Jean Koudou and Alfred S. Traore

The antimicrobial activity of the total alkaloids from the leaves of *Mitragyna inermis* (Willd.) O. Kuntze (Rubiaceae) From Burkina Faso was evaluated using disc diffusion essay and broth microdilution assay. The extract was used against ten (10) reference bacterial strains and three (3) clinical isolates including Gram(+) and Gram(-) strains. The alkaloids showed moderate activity against microorganisms tested. The highest Diameter of Inhibition Zone (DIZ) was obtained with *S. aureus* ATCC9244 (23±1 mm). The lowest Minimum Inhibitory Concentration (MIC) obtained was 0.625 mg mL⁻¹ recorded with three (3) Gram(+) bacteria (*S. aureus* ATCC 25293, *S. aureus* (clinical isolate) and *S. carmorum* LMG 13567) and one Gram(-) strain (*P. mirabilis* CIP104588). Results showed that Gram(+) bacteria are more sensitive to alkaloids from *M. inermis* than Gram(-) bacteria. This study confirmed the use of the plant in traditional medicine against some infectious diseases. (*Asian Journal of Plant Sciences* 8 (2): 172-177, 2009; doi: 10.3923/ajps.2009.172.177)

The Survey of Raisin Marketing Process and Structure in North Khorasan Province

M. Ghorbani and A. Darijani

This study investigated marketing process and structure of raisin in North Khorasan Province. Survey data were collected from 187 producers, 12

middleman, 2 processing factories and one rural cooperative society in 2003. The results showed that the share of producer, marketing margin and marketing cost in export price in main channel of marketing (producer, middleman, manufactory, export) are 55.3, 44.6 and 26.9%, respectively. Also, the marketing efficiency of main channel (with high market share) is less than the second channel (producer, cooperative, manufactory, export). Regard to results, establishment rural purchasing center with guarantee price, improving efficiency of extension service, training for better processing so as to improve quality of product, constructing marketing data banks as well as undertaking marketing research can increase total profit and social welfare through reducing marketing costs. (*Asian Journal of Plant Sciences* 8 (2): 178-182, 2009; doi: 10.3923/ajps.2009.178.182)

Effects of Removing Aerial Biomass and Density on Carbon Sequestration and Weight of *Atriplex lentiformis*

K. Mahdavi, A. Sanadgol, H. Azarnivand, S. Babaei Kafaki, M. Jafari, M. Maleki and A. Malekian

The objective of this research was to investigate the effects of removing aerial biomass and density of *Atriplex lentiformis* plantation on carbon sequestration and biomass in a split-split plot design with three replications in Ardestan, Iran. The results revealed that the highest amount of carbon sequestration produced by treatment of 2×2 m row spacing, annual removing and control height removal. The values of carbon storage of aerial biomass, among row spacing and removal of aerial biomass treatments were significantly different ($p < 0.05$). The highest carbon storage content was related also to 2×2 m row spacing and control with 60 cm height removing. None of the treatments was significantly different, concerning soil carbon storage ($p < 0.05$). Moreover, the highest biomass weight was in row spacing of 2×2 m while the lowest value was recorded in 6×6 m. (*Asian Journal of Plant Sciences* 8 (2): 183-186, 2009; doi: 10.3923/ajps.2009.183.186)

***Ziziphus spina-christi*, a Native Plant from Khuzestan, Iran, as a Potential Source for Discovery New Antimicrobial Agents**

H. Motamedi, A. Safary, S. Maleki and S.M. Seyyednejad

The antibacterial activity of *Ziziphus spina-christi* leaves ethanolic and methanolic extracts were examined using agar disc diffusion method against eight bacteria (*Salmonella typhi*, *Proteus mirabilis*, *Shigella dysenteriae*, *Escherichia coli*, *Klebsiella pneumoniae*, *Brucella melitensis*, *Bordetella bronchiseptica* and

Pseudomonas aeruginosa). These extracts had inhibitory effect at various concentrations (0.05, 0.1, 0.2, 0.3 and 0.4 g mL⁻¹) against tested bacteria. The ethanolic extract had the highest activity (20 mm) against *B. bronchiseptica* while the lowest activity (7 mm) was demonstrated by the methanolic extract on *K. pneumoniae*. Studies on the Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) of the methanolic extract on two selected bacteria showed that the *S. dysenteriae* had the highest MIC (18 mg mL⁻¹) and MBC (64 mg mL⁻¹) values. (*Asian Journal of Plant Sciences* 8 (2): 187-190, 2009; doi: 10.3923/ajps.2009.187.190)

Function of Mitogen-Activated Protein Kinase Gene in Biotic Stress

K. Nadarajah, N.M. Kasim and V.V. Fui

In this study, we describe the gene that codes for MAPK in *Oryza rufipogon* and *Oryza sativa* that reacts towards the blast disease (causative agent is *Magnaporthe grisea*) and brown planthoppers (*Nilaparvata lugens*). This gene has been isolated and characterized in *Oryza sativa* and in this study the same gene has been isolated from *Oryza rufipogon* using *OsMKK1* as a template and named *OrMKK1*. Through conducting this study, we found that *Oryza rufipogon* contains two copies of the *MAPK* gene in its genome. A comparative study was conducted between *OrMKK1* and *OsMKK1*; and the results showed that both these genes responded towards biotic stress. Though both the genes share a high level of amino acid similarities (94%), the kinetic reactions of both genes are different. (*Asian Journal of Plant Sciences* 8 (3): 191-198, 2009; doi: 10.3923/ajps.2009.191.198)

Calli Induction through Anther Culture in Peach-Tomato Plants (*Solanum sessiliflorum* Dunal)

I. Romani, A.R. Schuelter, F. Mora, C.A. Scapim and E.C.G. Vendruscolo

Flower buds from peach tomato plants (*Solanum sessiliflorum*) were collected to the establishment of a protocol of calli induction from anthers culture. Aseptic cultures were achieved after the immersion of explants into 70% ethanol for 45 sec followed by 0.8% sodium hypochlorite for 5 min. Cultivated anthers developed 50 and 70% of calli with 0.1 mg L⁻¹ indole-3-acetic acid (IAA)+5 mg L⁻¹ kinetin (KIN) and 0.1 mg L⁻¹ indole-3-acetic acid (IAA)+10 mg L⁻¹ kinetin (KIN), respectively. The calli oxidation increased in treatments free of activated charcoal,

daily pre-refrigeration (4°C for 48 h) and 20 mg L⁻¹ of kinetin (KIN). The best plant growth regulator concentration for stimulating calli formation was 5 mg L⁻¹ of kinetin (KIN). (*Asian Journal of Plant Sciences* 8 (3): 199-205, 2009; doi: 10.3923/ajps.2009.199.205)

***In vitro* Assessment of Tolerance of *Orthosiphon stamineus* to Induced Water and Salinity Stress**

A.S.Y. Ting, L.M. Tan and A.P.K. Ling

The response of *in vitro* plantlets of *Orthosiphon stamineus* to water and salinity stress indicated potential tolerance to both stress, with better tolerance to water-stress detected. Survival and vegetative growth was not severely affected for plantlets under induced water or salinity stress. Tolerance to water and salinity stress might be attributed to the proline and total soluble proteins produced. The levels for both biochemical markers significantly increased and correlated positively to the increasing concentrations of polyethylene glycol (PEG) and sodium chloride (NaCl) used. However, the chlorophyll content in *Orthosiphon stamineus* were reduced with the increase in concentrations of NaCl. Therefore, *Orthosiphon stamineus* show better tolerance to water stress than salinity stress, as survival rate, growth (fresh weight), proline level, total soluble protein and chlorophyll content in plantlets under water stress were relatively higher than plantlets challenged with salinity stress. (*Asian Journal of Plant Sciences* 8 (3): 206-211, 2009; doi: 10.3923/ajps.2009.206.211)

Bract Size Enlargement and Longevity of *Bougainvillea spectabilis* as Affected by GA₃ and Phloemic Stress

Mohammed Saifuddin, A.B.M. Sharif Hossain, Normaniza Osman and K.M. Moneruzzaman

A field experiment was conducted to assess the effect of gibberellic acid (GA₃, 100 and 150 ppm), phloemic stress and combination of 100 ppm GA₃ and phloemic stress on *Bougainvillea* bract blooming, expansion, development and bract longevity under exposed sun light condition (400-700 μEm⁻²sec⁻¹). A seven-years-old *Bougainvillea* plant was used in this experiment. Fifteen selected branches were applied with 100, 150 ppm GA₃, phloemic stress, 100 ppm GA₃+phloemic stress and water control. The results showed that 100 ppm GA₃ increased the length of petiole, bract size and shape by 40%. Bract blooming was three days earlier in 100 ppm GA₃ treated branches and 4 days earlier in 150 ppm

GA₃ than in water control. Bract longevity (required days from bract initiation to abscission) was higher for 4 in phloemic stress and for 2 days in 100 ppm GA₃+phloemic stress than in water control. However, bract longevity was shorter in 100 and 150 ppm GA₃ than in control. The number of bracts per branch was higher in 100 ppm GA₃+phloemic stress and phloemic stress than the other treatments. Petal size and petiole length were the highest in 100 ppm GA₃. But there were no significant changes in bract size and color development in phloemic stress. Maximum chlorophyll fluorescence was observed in phloemic stress. Quantum yield (F_v/F_m) was higher in phloemic stress and 100 ppm GA₃+phloemic stress than in other treatments. The findings suggested that gibberellic acid played an important role to induce rapid bract blooming and expansion whereas, phloemic stress increased total number of bract and longevity. (*Asian Journal of Plant Sciences* 8 (3): 212-217, 2009; doi: 10.3923/ajps.2009.212.217)

Assessment of Nature and Magnitude of Genetic Diversity Based on DNA Polymorphism with RAPD Technique in Traditional Glutinous Rice (*Oryza sativa* L.) of Assam

B. Shaptadvipa and R.N. Sarma

Extent of genetic diversity based on DNA polymorphism with RAPD technique was studied at Assam Agricultural University, Jorhat during 2004-06 with seeds of 41 indigenous glutinous rice germplasm collected from two diverse agro-climatic zones prevailing in the Brahmaputra Valley and the Barak sub-basin of Northeast India. Ten random RAPD primers generated 214 fragments, out of which 209 were polymorphic (97.77%). With RAPD marker, the index of genetic similarities ranged from 0.078 to 0.623, 0.160 to 0.481 and 0.114 to 0.633 in overall, in Birain and in Bora-Chokuwa groups, respectively. Some of the RAPD fragments could be used to develop group specific markers (for example, OPK-14₂₀₀ in Bora-Chokuwa group and OPK-14₆₀₀ in Birain group). (*Asian Journal of Plant Sciences* 8 (3): 218-223, 2009; doi: 10.3923/ajps.2009.218.223)

Molecular Detection of a Drought Stress-Inducible D-Amino Acid Oxidase Gene from *Zea mays* L.

A. Gholizadeh, M.H. Faizi and B.B. Kohnehrouz

In this research, the induction of maize DAAO gene was investigated under drought stress conditions. RT-PCR end product analysis of the mRNA samples

purified from stressed and non-stressed leaves showed that DAAO gene is only expressed in stressed plants. The results indicated that DAAO transcript is consistently detected overtime as stress conditions continued, but it fell below the limit of detection when plants are completely dried/died. This result may be consistent with the earlier reports that points the accumulation of D-amino acids and expression of DAAO activity during mammals aging or tissue developments in which PCD is involved. Cloning and sequencing of the expressed product revealed that the induced cDNA nucleotide and deduced amino acid sequences are 100% identical to DAAO gene that is expressed when maize plants utilize D-alanine as nitrogen source. This finding may provide new insights into the active role of D-amino acid oxidase gene and lead to the ways for the new studies on plant DAAO in the future. (*Asian Journal of Plant Sciences* 8 (3): 224-229, 2009; **doi**: 10.3923/ajps.2009.224.229)

Ecological Studies on *Salix* Distribution in Egypt

Emad A. Al Sherif, Wafaa Amer, Salah Eldin Ali Khodary and Walaa Azmy

The present research studied the ecological factors affecting *Salix* distribution in Egypt. Two species of *Salix* were recorded, *S. tetrasperma* (only male) and *S. mucronata* (both sexes). They were recorded at River Nile canal system and in the Eastern Oasis. Female *S. mucronata* was recorded in the all studied habitats, where the male of same species was recorded only in Fayoum Region. *Salix tetrasperma* neither recorded in Upper Egypt nor Eastern Oasis. Elevation from water surface, soil texture, soil salinity and temperature were the most effective factors affecting the distribution of *Salix* sp. (*Asian Journal of Plant Sciences* 8 (3): 230-234, 2009; **doi**: 10.3923/ajps.2009.230.234)

Effect of Intercropping Maize (*Zea mays* L.) With Cow Pea (*Vigna unguiculata* L.) on Green Forage Yield and Quality Evaluation

Mehdi Dahmardeh, Ahmad Ghanbari, Baratali Syasar and Mahmood Ramroudi

In this study effect of different planting ratios and harvest time of intercropping maize and cowpea on economical and biological yield and quality of maize forage (*Zea mays* L.) was evaluated in the Department of Agronomy, University of Zabol, during 2007. The planting ratios of maize to bean was 100:100, 50:100,

100:50, 25:75, 75:25, 50:50, 0:100 and 100:0, respectively. The intercropped of maize and bean in different planting ratio significantly affected the quantitative and qualitative characters of the forage. The highest yield of green fodder (65.7 t ha^{-1}) was obtained by sowing the crops in ratio of 100:100. The highest grain yield (9.0 t ha^{-1}) for maize was recorded from 75+25% ratio, maize and cowpea and the highest grain yield for cowpea (3.9 t ha^{-1}) was recorded from 50+100% ratio, maize and cowpea, respectively. The highest crude protein (19.65%) was produced by the cowpea sole cropping and the lowest from the maize plots sole cropping (12.11%). The highest land equivalent ratio (2.26) was obtained by sowing the crops in ratio of 100:100 and the highest crude protein was obtained by harvest time in milky stage (15.2%). (*Asian Journal of Plant Sciences* 8 (3): 235-239, 2009; doi: 10.3923/ajps.2009.235.239)

Antioxidant Activity and Osmolyte Concentration of Sorghum (*Sorghum bicolor*) and Wheat (*Triticum aestivum*) Genotypes under Salinity Stress

Mostafa Heidari

Seedling of two sorghum genotypes (Payam and Sistan) and four wheat genotypes (Bolani, Hirman, Star and Toss) were grown in Hoagland nutrient solution containing 0, 100 and 200 mM NaCl in controlled environment. Antioxidant activities like catalase (CAT), ascorbate peroxidase (APX) and guaiacol peroxidase (GPX) and osmolyte concentrations, proline and soluble carbohydrates were determined in the leaves 20 days after induction of salinity stress. Results showed that the activity of APX, GPX and CAT increased in both sorghum genotypes. Wheat genotypes showed significant differences during the experimental period. By increasing NaCl levels from 0 to 200 mM the activity of APX and GPX decreased, but the activity of CAT increased in all wheat genotypes. At the 100 mM NaCl, the CAT activity in wheat genotypes was higher compared with that in 200 mM NaCl. The increase in salinity stress increased total soluble carbohydrates and proline both in wheat and sorghum genotypes. Results in this study showed sorghum genotype displayed better osmotic adjustment and antioxidant compounds under salt stress and the efficiency of Sistan was better than Payam. Contrarily in wheat, osmotic adjustment (carbohydrate and proline accumulation) was much more effective than antioxidant enzyme activity. (*Asian Journal of Plant Sciences* 8 (3): 240-244, 2009; doi: 10.3923/ajps.2009.240.244)

The Influence of Water Stress on Biomass and Harvest Index in Three Mung Bean (*Vigna radiata* (L.) R. Wilczek) Cultivars

Omid Sadeghipour

The effect of water stress at the vegetative and reproductive growth stages and also no stress conditions on Biomass (B), Harvest Index (HI), Plant Height (PH) and Seed Protein Content (SP) of three mung bean cultivars (Partow, Barymung-2 and vc6368) were investigated. Experiment was conducted at the experimental farm of the Islamic Azad University of Shahre-rey, in Tehran, Iran, during summer 2008. The experiment was set up in a split plot on the basis of complete block design with four replications that placed water stress levels in the main plots and cultivars in sub plots. Correlation coefficients between some traits showed that, Seed Yield (SY) correlated positively with HI ($r = 0.829^{**}$), B ($r = 0.918^{**}$) and PH ($r = 0.516^{**}$). HI correlated positively with B ($r = 0.595^{**}$). Also, results indicated that the water stress decreased the B, HI and PH, while increased SP in three cultivars. Water stress at the flowering stage was more effective than vegetative stage on B, HI and SP, but less effective on PH. Cultivar partow was less affected, which showed its adaptability to the water stress conditions. Thus, mung bean is most sensitive to the water stress imposes at the flowering stage and in dry regions of Iran can be cultivated the Partow, in addition, for improvement in yield of mung bean, major emphasis should be placed on the B, HI and PH. (*Asian Journal of Plant Sciences* 8 (3): 245-249, 2009; doi: 10.3923/ajps.2009.245.249)

Relationship Between Rapid Canopy Closure and Grain Yield in Wheat

T. Mir-Mahmoodi and H. Soleimanzadeh

In order to determine the relationship between rapid canopy closure and grain yield in wheat and to identify the traits that affect rapid canopy closure, a research was conducted using 5 wheat cultivars (Atrak, Tajan, Zagros, Golestan and Viniak). A field experiment with randomized complete blocks was carried out at the Gorgan University of Agricultural Science and Natural Resources, in 2003-2004. Rapid canopy closure had significant effect on grain yield, cultivars with faster canopy closure produced comparatively more grain yield per unit area. Leaf area index and seedling dry weight at the beginning of the exponential growth phase; relative leaf area development rate and relative growth rate during the exponential phase and the average of individual leaf area and leaf area ratio were

detected as the effective traits in rapid canopy closure. It was concluded that the RCC is an appropriate way especially in the environment where growing season is limited and there is little scope for lengthening the growing season in order to increase dry matter production and yield. (*Asian Journal of Plant Sciences* 8 (3): 250-253, 2009; *doi*: 10.3923/ajps.2009.250.253)

Variability in Yield Responses of Peanut (*Arachis hypogaea* L.) Genotypes under Early Season Drought

D. Puangbut, S. Jogloy, N. Vorasoot, C. Akkasaeng, T. Kesmala and A. Patanothai

The objectives of the present study were to investigate the variability in yield responses of peanut genotypes subjected to Early Season Drought (ESD) and to evaluate characters associated with yield. The field experiment was conducted in the rainy and dry seasons. Eleven genotypes of peanut and two water regimes (field capacity and 1/3 available soil water) were laid out in split plot design with four replications. Where, water regimes were assigned in main plots and 11 peanut genotypes were laid out in subplots. Imposition of ESD following re-watering resulted in an increase of pod yield compared to the irrigated treatment. Significant genotypic differences in yield response in relation to ESD were observed in this study and this could be useful in selecting desired genotypes in peanut breeding program. The highest pod yields were found in ICGV 98303 and Tainan 9 in the rainy season, whereas, in the dry season, ICGV 98303 was still highest for pod yield followed by ICGV 98300. After re-watering, SPAD chlorophyll meter reading, leaf area index and biomass productions were increased. Thus, increase in yield was associated with high biomass production after recovery combined with great green leaf area and concentration of leaf chlorophyll. (*Asian Journal of Plant Sciences* 8 (4): 254-264, 2009; *doi*: 10.3923/ajps.2009.254.264)

Inheritance of Traits Related to Biological Nitrogen Fixation and Genotypic Correlation of Traits Related to Nitrogen Fixation, Yield and Drought Tolerance in Peanut (*Arachis hypogaea* L.) Under Early Drought

H. Wunna, S. Jogloy, B. Toomsan, J. Sanitchon and A. Patanothai

The improvement of peanut for drought tolerance and high N₂-fixation is the best way to enhance peanut production under drought condition. Besides, the

heritability estimates of traits related N₂-fixation and its genetic correlation with yield and drought tolerant traits are useful to formulate the effective breeding program under drought. Therefore, the aims of this study were to estimate the heritabilities (h²) and genotypic correlation (r_G) among traits related to N₂-fixation (TNf), yield and drought tolerant traits under early drought and non stressed condition. Ninety lines in the F_{4,8} generations from four peanut crosses were tested under Field Capacity (FC) and one-third Available Water (1/3 AW). Data were recorded for Nodules Dry Weight (NDW), Biomass Production (BM), Pods Yield (PY), number of pod plant⁻¹, number of seed pod⁻¹ and 100 seed weight at harvest. Specific Leaf Area (SLA), SPAD Chlorophyll Meter Reading (SCMR), Harvest Index (HI) and Drought Tolerance Index (DTI) of PY and BM were measured and calculated as drought tolerant traits. The h² for BM, PY, number of pod plant⁻¹ and 100 seed weight were high for all tested crosses under both water regimes. With exception of HI trait, high h² estimates, also, were found for drought tolerant traits under both water regimes. The genotypic correlation (r_G) between NDW and BM was positive highly significant under both 1/3 AW and FC. BM and PY showed high r_G, whereas, BM and 100 seed weight showed moderate r_G. Moderate r_G was found between BM and SCMR 60 DAE under 1/3 AW and FC. Significant correlations between FC and early drought were found for BM indicating that selection of this trait could be done under both water regimes. BM is possible to select and breed for high N₂-fixation, PY and possibly, drought tolerance because of high h² and significant r_G with PY and SCMR 60DAE. (*Asian Journal of Plant Sciences* 8 (4): 265-275, 2009; doi: 10.3923/ajps.2009.265.275)

Effects of Abscisic Acid on Somatic Embryogenesis and Induction of Desiccation Tolerance in *Brassica napus*

R. Angoshtari, R. Tavakkol Afshari, S. Kalantari and M. Omidi

The present study describes, firstly, the effect of cultivar, photoenvironment and different abscisic acid (ABA) treatments on somatic embryogenesis in *Brassica napus* and secondly, describes the effects of ABA and drying rates on acquisition desiccation tolerance in cultivar *Opera*. In embryogenesis experiment, 20 days old cotyledon-derived calli were cultured in somatic embryo induction media with different concentrations of ABA (0, 0.5, 10 and 50 μM). These were incubated either in the dark or light. The calli were transferred to the same medium with either the same ABA or different ABA concentrations every 10 days. After 30 days the numbers of mature somatic embryos were counted. The results showed that light stimulated somatic embryo formation and maturation. Furthermore,

differences in ABA response related to somatic embryogenesis were observed between cultivars. Also, embryos were likely more sensitive to ABA in days 1-10 and 21-30. For desiccation experiment, three ABA treatments were chosen from cultivar *Opera*. Then these embryos were cultured in germination medium without dehydration or dehydrated either with a fast dehydration rate or a slow dehydration rate before culturing in germination medium. The results showed that ABA treated embryos were more desiccation tolerant than non ABA treated embryos. It also showed that as the concentration of ABA increased, embryos tolerance to desiccation also increased. Moreover, slow drying rate was more beneficial for desiccation tolerance induction than fast drying in ABA treated embryos. In addition, ABA treated embryos had higher germination rates even when they were not dehydrated. (*Asian Journal of Plant Sciences* 8 (4): 276-284, 2009; **doi**: 10.3923/ajps.2009.276.284)

Expression Pattern of *GS3* During Panicle Development in Rice under Drought Stress: Quantification Normalized Against Selected Housekeeping Genes in Real-Time PCR

Jia-Liang Zhang, Dong-Hua Liu, Zhi-Hua Wang, Can Yu, Jin-Hua Cao, Chun-Tai Wang and De-Ming Jin

Many studies on mechanisms under drought stress have been based on gene expression. Quantitative Real-Time PCR (QRT-PCR) is the most sensitive method to detect the transcript of interest gene. To avoid bias, expression of the target gene is usually normalized relative to one or multiple reference genes which should not fluctuate in all samples. The most widely used reference genes are those which belong to *actin* family; however, many researchers make use of paralogous genes for *actin* without proper validation of their presumed stability of expression. If an unstable housekeeping gene (HKG) is selected to normalize the target, the results obtained may be spurious. So, we evaluated the gene expression of 10 HKGs, including 8 paralogous genes for *actin*, together with *b-tub* and *eEF-1a* in rice. For the entire sample pools analyzed, ACT(X16280)1 and *eEF-1a* were the most stable genes in the different stages of rice panicle development. In this study, we used ACT(X16280)1, *eEF-1a* and the geometric mean of ACT(X16280)1 and *eEF-1a* as internal controls to study the relative expression of gene *GS3*, controlling grain length and weight, during different stages of panicle development under drought stress. A sharp increase of *GS3* expression (up to 4.8 fold) at spikelet primordium differentiation stage was observed under drought stress. The shrinking of grain size under drought stress could be attributed to the over expression of *GS3* which is a negative regulator for grain size. (*Asian Journal of Plant Sciences* 8 (4): 285-292, 2009; **doi**: 10.3923/ajps.2009.285.292)

A Study of Agronomic and Morphological Variations in Certain Alfalfa (*Medicago sativa* L.) Ecotypes of the Cold Region of Iran

M. Basafa and M. Taherian

The objective of this study was to characterize and classify the genetic diversity among alfalfa (*Medicago sativa* L.) ecotypes collected from the cold regions of Iran, based on some agro-morphological traits. Twenty one alfalfa ecotypes were collected and planted in a Randomized Complete Blocks Design (RCBD) with three replications in April 1998 at Nyshabour Agricultural and Natural Resource Research Station, Khorasan Razavi, Iran. Twenty three above ground agro-morphological characters were recorded during the growing seasons of 1999-2001. The variables were analyzed by descriptive statistics and multivariate statistical procedures to discriminate differences among genotypes and determine groups based on their similarities. Factor analysis was performed for all agro-morphological traits and reduced them down to 6 common factors which accounted for 80.45% of total variations among the genotypes studied. The twenty one ecotypes were classified in to 4 clusters by cluster analysis. Each group had at least one trait which made it different from the other groups (group 1: No. of pods per raceme and 100-seed weight; group 2: forage yield, dry matter yield, regrowth rate and stem dry matter yield; group 3: leaf-stem ratio, leaf dry matter yield and group 4: seed yield). These results suggest the presence of variation among alfalfa ecotypes available in cold regions in Iran, which could be considered for further breeding strategies and studies. (*Asian Journal of Plant Sciences* 8 (4): 293-300, 2009; *doi*: 10.3923/ajps.2009.293.300)

Some Quality Components of Four Chia (*Salvia hispanica* L.) Genotypes Grown under Tropical Coastal Desert Ecosystem Conditions

R. Ayerza and W. Coates

A chia (*Salvia hispanica* L.) trial in the Santa Elena Peninsula of Ecuador consisted of 4 genotypes (Tzotzol, Iztac 1, Iztac 2 and Miztic) sown on January 15, 2007 in replicated plots to assess production and composition. Seed yield was affected by genotype, with Miztic and Tzotzol producing significantly ($p < 0.05$) greater yields than the Iztac II genotype, but not more than Iztac I which was not significantly ($p < 0.05$) different from Iztac II. Iztac II had the highest protein content (24.43%), however the difference was significantly ($p < 0.05$) different only

from Iztac I. Neither Iztac II nor Iztac I were significantly ($p < 0.05$) different from either the Tzotzol or Miztic genotypes. No significant difference ($p < 0.05$) in lipid content was found among genotypes. Miztic and Iztac II, with 20.23% and 20.03%, respectively had significantly ($p < 0.05$) higher linoleic fatty acid percentages than the 19.23% of the Iztac I genotype. Iztac I had the highest α -linolenic fatty acid percentage (61.73) and this was significantly ($p < 0.05$) different than the 58.37% found for the Iztac II genotype. All of the genotypes showed a similar relationship among compounds, that being caffeic acid > chlorogenic acid > quercetin > kaempferol. In summary, the effect of genotype was more evident on seed yield than protein content, oil content, fatty acid composition and phenolic compounds, hence yield needs to be the main factor when considering establishment of chia as a crop in the area. (*Asian Journal of Plant Sciences* 8 (4): 301-307, 2009; doi: 10.3923/ajps.2009.301.307)

Analysis of Free Amino Acid and Total Protein Content in Pollen of Some Allergenic Taxa

H. Özler, S. Pehlivan and F. Bayrak

This study reports the free amino acid content of pollen grains obtained from old and fresh samples belonging to *Pinus nigra* subsp. *nigra* var. *caramanica* (Loudon) Rehder (black pine) (Pinaceae), *Juglans regia* L. (walnut) (Juglandaceae), *Fraxinus angustifolia* Vahl. (ash) (Oleaceae) and *Betula pendula* L. (birch) (Betulaceae) obtained with the technique of Liquid Chromatography-Mass Spectrometry (LC/MS). Pollen samples were obtained from flowers of the above mentioned taxa in different years. Twenty one amino acids were identified. No histidine was found in *F. angustifolia* collected 8 years ago. Total protein content of *P. nigra* subsp. *nigra* var. *caramanica* pollens (25.75%) was higher than the remaining taxa; *F. angustifolia* (13.67%), *B. pendula* (7.73%) and *J. regia* (7.55%). (*Asian Journal of Plant Sciences* 8 (4): 308-312, 2009; doi: 10.3923/ajps.2009.308.312)

Effect of Explants Density on the *in vitro* Proliferation and Growth of Separated and Cluster Shoots of Smooth Cayenne Pineapple (*Ananas comosus* L. Merr.)

A.M. Hamad and R.M. Taha

Multiplication rate was always used as the sole parameter for assessment of the optimal treatment for *in vitro* shoot formation. However, beside its effect on the

shoot formation, different treatments had different impact on the production cost. Separated shoots and shoot cluster of different sizes (1, 2, 3 and 4 shoots per cluster) of Smooth cayenne pineapple were cultured at density of 1, 2, 3 and 4 separated shoots and 1 cluster on agar solidified full strength MS medium enriched with sucrose at 30 g L^{-1} and BAP at 2.25 mg L^{-1} for 2 months to investigate the effect of explants density and explant types on shoot formation per explant, total per liter and cost per shoot. Density of one separated shoot per culture resulted in the highest shoot formations per shoot (11 shoots) but lowest total shoot per liter (550 shoots) and highest cost per shoot (13 cents), while density of 4 shoots per culture resulted in lowest rate (4 shoots) but higher total per liter (1400 shoots) and lowest cost per shoot (10 cents). Cluster of two shoots had higher rate (7 shoots) and lower cost (16 cents) than cluster of 4 shoots (4 shoots and 20 cents) but both resulted in equal total shoot per liter (750 shoots). Separated shoot had higher shoot formation capacity, higher total per liter and lower cost per shoots than cluster of shoots and using of total per liter instead of rate per explant was the best parameter for selection of treatment of lower cost and higher shoots production. (*Asian Journal of Plant Sciences* 8 (4): 313-317, 2009; *doi*: 10.3923/ajps.2009.313.317)

Mutagenic Effectiveness and Efficiency of Gamma Rays, Ethyl Methane Sulphonate and their Combination Treatments in Chickpea (*Cicer arietinum* L.)

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The present study was undertaken to assess the effectiveness and efficiency of gamma rays, EMS and their combined treatments in chickpea. Seeds of two varieties of chickpea (*Cicer arietinum* L.) were treated with gamma rays (150 Gy, 200G y, 300G y and 400G y), EMS (0.1, 0.2, 0.3 and 0.4%) and their combinations (200 Gy+0.2% EMS, 300 Gy+0.2% EMS, 200 Gy+0.3% EMS and 300 Gy+0.3% EMS). The biological damage was calculated in M_1 generation based on seed lethality (L), seedling injury (I), pollen sterility (S) and meiotic aberrations (M). The M_2 population was carefully screened for various chlorophyll mutations. Mutagenic effectiveness and efficiency was calculated based on biological damage in M_1 and chlorophyll mutations in M_2 . Mutagenic effectiveness increased with the increase in dose/treatment. Combination treatments in general proved to be more effective followed by individual treatments of EMS and gamma rays. Mutagenic efficiency varied depending upon the criteria selected for its estimation and the degree of efficiency of various mutagens also showed variation. Intermediate treatments in general were found more efficient in causing less

biological damage and inducing maximum amount of mutations. The order of efficiency, however, was gamma rays+EMS>EMS>gamma rays. Among the two varieties, var. Pusa-372 proved to be more sensitive to mutagenic treatment than the var. Pusa-212. (*Asian Journal of Plant Sciences* 8 (4): 318-321, 2009; doi: 10.3923/ajps.2009.318.321)

Seed Protein Study on Some Populations of *Salvia* (Lamiaceae) using Electrophoresis Technique in North-East of Iran

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Salvia L. belongs to Lamiaceae family, have 900 species around the world. Seven of them distributed in Mashhad (North-East of Iran) which are following: *S. spinosa* L., *S. staminea* Montbr and Auch, *S. sclarea* L., *S. chloroleuca* Rech and Aell., *S. virgata* Jacq, *S. chorassanica* Bung. and *S. nemorosa* L. In present research seed proteins of *Salvia sclarea* L., *S. spinosa* L. and *S. chloroleuca* Rech and Aell. studied by sodium dodecylsulphate polyacrylamide gel electrophoresis (SDS-PAGE) method. The aim of present study was identifying the variation between seed protein in populations and relationship with morphological characters and geographical distance. Analysis showed 22 bands from which some of them were specific for a population. Cluster analysis of populations were carried out. The variation bands have correspondence to geographical distance and morphological characters. (*Asian Journal of Plant Sciences* 8 (4): 322-324, 2009; doi: 10.3923/ajps.2009.322.324)

Heritability and Correlation of Drought Resistance Traits and Agronomic Traits in Peanut (*Arachis hypogaea* L.)

M. Painawadee, S. Jogloy, T. Kesmala, C. Akkasaeng and A. Patanothai

Several physio-morphological traits are related to pod yield of peanut. Improvement of these traits should lead to yield increase under drought conditions. The objective of this study was to evaluate (1) heritability of drought resistance traits, yield and yield components and (2) relationships among these traits. A cross of two parents (ICGV 98324 and KK 4) differing in physio-morphological traits was used in this study. Pot experiments of F₂ and F₃ populations were set up in the open field with rainout shelters. One hundred and twenty eight entries were subjected to water stress during 28 to 70 days after sowing and evaluation of the studied characters was conducted at appropriate time. Data were recorded for Root Dry Weight (RDW), Root Length (RL), Root Surface (RS), Root Volume

(RV), Specific Leaf Area (SLA), SPAD Chlorophyll Meter Reading (SCMR), biomass, pod yield, pod number per plant, seed number per pod, 100-seed weight and Harvest Index (HI). Heritability estimates in broad sense for root characters and drought resistance traits were low to intermediate, ranging from 0.27 to 0.59. Similarly, low to intermediate heritability estimates in broad sense were found for pod yield and yield components, ranging from 0.20 to 0.57. Heritability estimates in narrow sense were much lower than in broad sense. The correlation coefficients among root characters were inter-related positively, whereas negative correlation coefficients were observed among physiological characters. Root characters were closely related to biomass production but they were not related to yield and yield components except for pod number per plant. (*Asian Journal of Plant Sciences* 8 (5): 325-334, 2009; **doi:** 10.3923/ajps.2009.325.334)

Relations among Growth, Nodulation, P Efficiency and Proton Efflux for Annual Legumes

K. Sungthongwises, R. Poss and J.J. Drevon

Although, cowpea is more tolerant to phosphorus deficiency than soybean and common bean, whether this better tolerance is related to a greater P Use Efficiency (PUE) or higher specific nodule activity is not well documented. In this study, we screened different annual legumes in the glasshouse for their genotypic diversity in PUE for Symbiotic Nitrogen Fixation (SNF) and their proton efflux from roots. After growing 4 weeks in hydro-aeroponic conditions, the plants were transferred into serum bottles and on soil bags on a Chromic Cambisol soil from France or an Acid Sandy soil from Northeast Thailand until harvested. Almost all *V. unguiculata* cultivars nodulated on the Chromic Cambisol soil, but not on the Acid Sandy soil from Thailand. In this experiment, *V. unguiculata* showed mainly a better growth under P sub-deficiency ($75 \mu\text{mol P week}^{-1}$) than P sufficiency ($250 \mu\text{mol P week}^{-1}$) and a greater PUE rather than a higher specific nodule activity. *V. unguiculata* cv. 26-73 had the lowest proton efflux among all the cultivars. However, when *V. unguiculata* was grown on the Acid Sandy soil, we noticed a significant decrease in soil pH and the P applications tended to increase soil pH. According to the results from our trials, *V. unguiculata* is the most interesting grain legume to grow as it proved to be more tolerant to phosphorus deficiency. We especially recommend using cv. 26-73, since it was responsible for a smaller H^+ efflux than the other cultivars. (*Asian Journal of Plant Sciences* 8 (5): 335-343, 2009; **doi:** 10.3923/ajps.2009.335.343)

Identification of Differentially Expressed Proteins Associated with Chlorophyll-Deficient Mutant Rice

Hong-Xia Dong, Hai-Xia Li, Guo-Sheng Xie and Han-Lai Zeng

In plant, chlorophyll-deficient mutants have been employed to study the mechanism of chlorophyll and chloroplast biogenesis. Here, we found a new chlorophyll-deficient mutant rice line (W02S) whose leaves became etiolated at two-leaf stage and turned into green at three-leaf stage different from that of its isogenic rice line (Peiai64S). Compared with Peiai64S, 44 differentially-expressed proteins were selected in the two-leaf stage of W02S by the means of 2-D gel electrophoresis and MALDI-TOF MS analysis. Among the identified ten categories, four highly expressed protein spots involved in the EMP-TCA pathway and protein expressions were selected for real-time quantitative PCR analysis. The mRNA levels of three genes encoding an enolase, a chloroplast 29 kDa ribonucleoprotein and a proteasome alpha subunit were significantly increased in the two-leaf-stage W02S, indicating that a substantial proportion of protein changes is the consequence of altered mRNA levels during the seedling stages of the mutant rice. These new findings lead us to better understand regulatory mechanisms of chlorophyll-deficient phenotype in rice and other plants. (*Asian Journal of Plant Sciences* 8 (5): 344-352, 2009; doi: 10.3923/ajps.2009.344.352)

Genotypic Variations in Terms of NH₃ Volatilization in Four Rice (*Oryza sativa* L.) Cultivars

Mingxia Chen, Jianliang Huang, Kehui Cui, Lixiao Nie and Farooq Shah

NH₃ volatilization from the cultivated rice (*Oryza sativa* L.) canopy is one of the major contributing factors of the N loss in the rice production. The objectives of this study are to examine the genotypic variations in NH₃ volatilization from canopy among the cultivars and to determine the mechanisms responsible for NH₃ volatilization from rice. With these aims, two pot experiments were conducted using Yoshida culture solution and four rice genotypes (the Yangdao-6, the Wuyujing-3, the BG34-8 and the Zhenshan-97) in greenhouse at Huazhong Agricultural University, Wuhan City, China. The amount of ammonia volatilized from different rice cultivars was evaluated at booting, heading and milking stages. At booting stage, inhibitors of glutamine synthetase (methionine sulfoximine (MSO)) and photorespiration (isonicotinyl hydrazine (INH)) were sprayed on leaves at 0.1 mmol L⁻¹ and 2 g L⁻¹, respectively. Genotypic variations in amount of NH₃ volatilized from canopy existed among the four rice cultivars at different

growth stages and N treatments. According to results, spraying of the MSO at 0.1 mmol L^{-1} was significantly increased the NH_3 volatilization from the rice canopy, while spraying INH at 2 g L^{-1} decreased the NH_3 volatilization. Obtained results were showed that rate of ammonia volatilization was negatively correlated with the leaf GS activity, while the leaf GO activity related positively to the rice ammonia volatilization. (*Asian Journal of Plant Sciences* 8 (5): 353-360, 2009; doi: 10.3923/ajps.2009.353.360)

Differential Methylation Pattern of *rolA*, *B* and *C* Genes of *Agrobacterium rhizogenes* in *Nicotiana glauca* and its Hybrid

D.R.S. Suneetha, A. Arundhati, G.S. Rao and P.V. Joshua

The present study tends to investigate the role of DNA methylation in silencing and expression of *rolA*, *B* and *C* genes in *Nicotiana glauca* and its hybrid, respectively. Exposure of the hybrid seed to 5-azacytidine, a DNA hypomethylating agent resulted severe alterations in morphology, early tumor induction and loss of phytohormone independent growth. On the contrary, DNA hypermethylation caused by cefotaxime treatment resulted in enhanced rate of tumorigenesis and callus growth. The above results convey that changes in DNA methylation in the hybrid plants possess a significant effect on tumorigenesis. Therefore, DNA isolated from the parents, hybrid and tumor were restriction digested with cytosine methylation specific isoschizomers MspI and HpaII; and Southern analysis was carried out using *rolA*, *B* and *C* genes as probes. The size of the bands differed in MspI and HpaII digests of *N. glauca*, hybrid and tumor whereas no signals were observed in *Nicotiana langsdorffii*. Results were discussed in terms of silencing of *rolA*, *B* and *C* genes in *N. glauca* and their expression in the hybrid. Hence, it could be concluded that DNA hypermethylation of *rol* genes in *N. glauca* resulted in their silencing causing normal morphology and behavior of the plant, whereas DNA hypomethylation of *rol* genes was responsible for their expression in the hybrid causing morphological abnormalities and tumorigenesis. (*Asian Journal of Plant Sciences* 8 (5): 361-367, 2009; doi: 10.3923/ajps.2009.361.367)

Effect of Genotype and Callus Induction Medium on Green Plant Regeneration from Anther of Nepalese Rice Cultivars

R.K. Niroula and H.P. Bimb

Effects of genotype and medium composition on the frequency of callus induction and green plant regeneration from anther of Nepalese rice were investigated. Cold

pretreated anthers from six rice genotypes at $8\pm 2^{\circ}\text{C}$ for seven days were cultured on three different callus induction media designated as Callus Induction Medium (CIM 1): N6 mineral salts + N6 vitamins (2 mg L^{-1} each) + myoinositol (100 mg L^{-1}) + 2,4-D (2.5 mg L^{-1}) + KI (0.5 mg L^{-1}) + AgNO_3 (10 mg L^{-1}) + maltose (50 g L^{-1}), CIM 2: N6 mineral salts + MS organic salts + NAA (4 mg L^{-1}) + Kinetin (KI) (2 mg L^{-1}) + Silver nitrate (AgNO_3) (5 mg L^{-1}) and sucrose $60\text{ (g L}^{-1})$ and CIM 3: CIM 2 without AgNO_3 . The callus induction frequency was significantly affected by rice genotypes and genotype x medium interactions. The efficiency of callus induction (calli/anther) was higher in CIM 1 (14.1%) followed by CIM 2 (12.54%) and CIM 3 (10.3%). CIM 2 was found to be superior for the recovery of green plants. Among genotypes, only the calli from Chandanath -3 and Khumal-4 were able to differentiate into green plants. In this study the calli induced on medium containing 2, 4-Dichloroacetic acid (2, 4-D) had lower regeneration ability than the medium supplied with α -naphthalene acetic acid (NAA). This study also revealed that the temperate cultivars (hill rice) were more responsive to anther culture than the tropical ones (terai rice). (*Asian Journal of Plant Sciences* 8 (5): 368-374, 2009; doi: 10.3923/ajps.2009.368.374)

Effect of Planting Depth and Control of Soil Summer Temperature on Tunic Production, Corm Propagation and Leaf Desiccation in End of Growth Period of Saffron (*Crocus sativus* L.)

M. Galavi, S.R. Mousavi and M. Ziyaie

In order to study the effect of planting depth and summer temperature control on tunic (corm fibers) production and leaf desiccating in end of growing season in Saffron (*Crocus sativus* L.) an experiment was conducted at Agricultural Research Station in Zabol University (Iran) during 2004-2005 growing seasons. The experiment was laid out in a split plot within a Randomized Complete Block Design (RCBD) with four replications. The main plots consisted of three planting depths (10, 15 and 20 cm) and three different methods for summer temperature control (control, mulching and irrigation) were arranged in subplots. The results showed leaf desiccating, corm fibers (tunic) and number of daughter corms (corms propagated) significantly decreased by increasing planting depth ($p<0.05$). In response to summer temperatures control treatments, leaf desiccating and number of daughter corms was decreased significantly ($p<0.05$), also summer temperatures control treatments had not a significant effect on tunic weight, however tunic weight decreased by mulching. Leaf desiccating, corm propagation

and tunic weight significantly affected by temperature control and planting depth interaction, maximum and minimum corn propagation and leaf desiccation time were obtained at 10 cm planting depth + control and 20 cm planting depth + mulching treatment, respectively. Maximum tunic weight was obtained at 10 cm planting depth and irrigation interaction. Tunic weight decreased by increasing planting depth and summer temperatures control treatments. (*Asian Journal of Plant Sciences* 8 (5): 375-379, 2009; doi: 10.3923/ajps.2009.375.379)

Study of Genetic Variation of Resistance to Sunn Pest using SPT Index

S.F. Hossaini, R. Haghparast, N. Bahrami and Y. Haghi

To study the response of advanced wheat genotypes to sunn pest, a research was conducted under free and non-free selection for sunn pest attack, using a randomized complete block design with 5 replications and 25 genotypes including, 19 advanced bread wheat, 4 durum wheat and 2 checks (Sardari and Azar-2). These genotypes were evaluated in Dryland Agricultural Research Sub-Institute, Kermanshah, Iran during 2007-2008. To identify tolerant genotypes to sunn pest we used SPTI (Sunn pest tolerance index). Significant difference were observed between genotypes for number of damaged central bud, number of adult sunn pest, number of new generation sunn pest, percent of damaged seed, grain yield and thousand seed weight. Based on mean ranks of SPTI, number of damaged central buds and percentage of damaged seeds, PATO1 was the most tolerant genotype and among durum wheat genotype Pgs was the best genotype. This result indicated selection based on grain yield is better than thousand seed weight. Sunn pest tolerance index is an index related to grain yield and it is a new good index for genotype selection. We purpose this index for new experiments. (*Asian Journal of Plant Sciences* 8 (5): 380-384, 2009; doi: 10.3923/ajps.2009.380.384)

Investigation of Physiological Indices of Different Rice (*Oryza sativa* L.) Varieties in Relation to Source and Sink Limitation.

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An experiment was conducted at Iran Rice Research Institute-Deputy of Mazandaran (Amol) in 2007, to study the physiological and morphological indices of different rice varieties. The experiment was carried out with, Factorial

experiment in randomized completely block design comprising four replications. Studied factors were limitation of source and sink in 4 treatments viz., (1) cut all of leaves except flag leaf, (2) cut flag leaves, (3) cut 1/3 end of panicle and (4) control. Variety in four treatment was as Tarom, Neda, Shafagh and Fajr. Completion of source and sink limitation treatments were carried out at 50% flowering stage. Results showed that the most CGR was related to Shafagh variety (25.18 g/m²/day) in 1650 GDD and the least CGR was produced in the Tarom variety (21.1 g/m²/day) in 1452 GDD. The most RGR was obtained in the Shafagh and the least RGR was obtained in the Neda variety at the 850 GDD. Completion source and sink limitation treatments on leaf area index showed that cut all leaves except flag leaves had least leaf area index also with cut all of leaves and flag leaves in all of varieties the RGR was decreased. Results of morphological characteristics measurement showed that highest plant height and least plant height were produced in the Tarom and Shafag varieties, respectively. Maximum leaves number in the Tarom variety was produced in the 1180 GDD. Also, the Neda variety with produced 24 tillers per plant had most tiller number. The Tarom variety with coefficient 81.25% had most conversion all tillers to fertile tiller percentage. (*Asian Journal of Plant Sciences* 8 (5): 385-389, 2009; doi: 10.3923/ajps.2009.385.389)

Potato (*Solanum tuberosum* L.) Response to Drip Irrigation Regimes and Plant Arrangements during Growth Periods

M. Shiri-e-Janagrad, A. Tobeh, S. Hokmalipour, Sh. Jamaati-e-Somarin, A. Abbasi and K. Shahbazi

A field experiment comparing different drip irrigation regimes and plant arrangements on potato yield and its component, leaf, stem and total dry matters, harvest index and water-use efficiency was carried out in a clay soil. This study was carried out on the experimental Farm of Ardebil Agriculture Research Station in 2006. The experiment included three treatments for different drip irrigation regimes: I1 (full irrigation), I2 (80% of full irrigation), I3 (60% of full irrigation) and three treatments for plant arrangements: conventional cultivation (P1), two rows 35 (P2) and 45 (P3) cm apart on a wide bed 150 cm. Results indicate that both drip irrigation regimes and plant arrangements didn't influence the harvest index. In all varieties, I1, I2 and I3 produced the lowest amounts, respectively. Plant arrangement hadn't significant impress on tuber yield, numbers and average weight of tubers. P3 and P2 treatments produced maximum and minimum values in more characteristics. The yield of tuber, leaf, stem, total and harvest index indicated increasing trend during the harvest times and only the stem and leaf yield

decreased at the two final harvests. In most variables interaction effect of the (I1×P3) generated. Accumulative amounts of reference and 100, 80 and 60% crop evapo-transpiration (EP) were 782.2, 627.6, 502.0 and 376.5, respectively. Water Use Efficiency (WUE) with increase water supply improved. Treatment of I1×P3 had the highest WUE. Its values during growth period increased and maximum WUE obtained at 109 Day after Planting (DAP). (*Asian Journal of Plant Sciences* 8 (6): 390-399, 2009; **doi:** 10.3923/ajps.2009.390.399)

Fine Mapping of Short Rachilla Hair Gene (*srh*) in Barley and an Association Study using Flanking Molecular Markers and World Germplasms

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Short rachilla hair in barley is controlled by a recessive gene *srh* that is located on the long arm of barley chromosome 5H. It shows a skewed geographical distribution toward the Occidental regions of barley cultivation. This morphological character is an attractive trait to study the phylogeny of barley. In a previous study, *srh* was mapped between two markers at a distance of 1.6 and 0.5 cm in the proximal and distal side, respectively. An integrated map was constructed during this experiment using the data from two F₂ populations and 320 homozygous recessive short rachilla hair plants from another population. The CAPS marker k06288KU and SSR marker Bmag0223 are found to be flanking short rachilla hair locus *srh* at a genetic distance of 1.6 and 4.0 cm, respectively. World barley germplasm collections of 192 accessions differing in rachilla type were surveyed using k06288KU and Bmag0223. SSR marker Bmag0223 showed a better association with *srh*. In Europe, North Africa and Ethiopia, the frequency of Bmag0223 allele A was high regardless of rachilla type, but in East Asia allele A was closely associated with short rachilla. On the basis of marker association and genetic diversity, the origin of short rachilla hair character in barley is discussed. (*Asian Journal of Plant Sciences* 8 (6): 400-408, 2009; **doi:** 10.3923/ajps.2009.400.408)

Effect of Temperature, Iso-Osmotic Concentrations of NaCl and PEG Agents on Germination and Some Seedling Growth Yield Components in Rice (*Oryza sativa* L.)

F. Mokhberdoran, S.M. Nabavi Kalat and R. Sadrabadi Haghghi

This study was conducted to evaluate seed performance under controlled condition and main aim is to show the effects of NaCl, polyethylene glycol (PEG)-

8000, temperature (20, 25 and 30°C) and their interactions on Seed Germination (SG) and Seedling Growth (SDG) of a single rice (*Oryza sativa*) cultivar which is the name of Kalat. It was obtained from one field harvested in 2008. Seeds were treated with the iso-osmotic concentrations of NaCl or PEG (0, -0.2, -0.4, -0.6 and -0.8 MPa) and exposed to the three temperatures (Namely, 20, 25 and 30°C) for 10 days. There were significant solution types (NaCl or PEG)×temperature×osmotic potentials interactions ($p<0.05$) on the FG, the Germination Rate (GR), the Radicle Length (RL), the Hypocotyl Length (HL), the Seedling Dry Weight (SDW) and the Fresh Weight (FW) indicating that the rice seeds responded differently to salt, drought and temperature changes. The highest values of germination parameters were obtained with no osmotic potential (0 MPa) and increases in osmotic potential either by NaCl or PEG inhibited germination indices. The results indicated that the reduction of germination characteristics was much greater for the PEG induced stress compared to the NaCl induced stress at all osmotic and all thermal levels. In addition, the rice seeds exhibited strong effect of change in temperature on germination characteristics. The deleterious effect of NaCl and PEG was more pronounced at 20 and 30°C compared to 25°C. The examined rice cultivar was more tolerant of NaCl salinity and water stress stimulated by the PEG in the germination stage than in the seedling developmental phase. (*Asian Journal of Plant Sciences* 8 (6): 409-416, 2009; doi: 10.3923/ajps.2009.409.416)

Gene Effects of Sugar Compositions in Waxy Corn

S. Simla, K. Lertrat and B. Suriharn

To supplement the selection for qualitative traits, the quantitative study by generation means analysis was carried out. The aim of this study was to determine gene effects for sugar contents (sucrose, glucose, fructose and total sugar) in two waxy corns crosses (101su×101bt and 101su×216sh₂-crosses). Three inbred lines (101su, 101bt and 216sh₂) homozygous in waxy gene were used as parents to generate six basic populations (P₁, P₂, F₁, F₂, BC₁₁ and BC₁₂). Eleven entries were planted in a randomized complete block design with three replications. The sugar contents were evaluated en masse from immature kernels at 21 days after pollination. The data were used in generation means analysis to understand gene effects. Dominance and epistatic gene effects explained most of genetic variation for sucrose and total sugar in both crosses. Negative dominance gene effect indicated that sugar content in the F₁ hybrids were not as high as that of their parents. Significant additive gene effect also indicated the synergistic effect of the sweet gene combinations. Based on the results, backcross or three-way cross is

the best choice to increase sweetness in waxy corn and the use of gene combinations is better than single gene. This information is useful for planning breeding strategies for improving sweetness in waxy corn. (*Asian Journal of Plant Sciences* 8 (6): 417-424, 2009; *doi*: 10.3923/ajps.2009.417.424)

Response to Four Cycles of Mass Selection for Prolificacy at Low and High Population Densities in Small Ear Waxy Corn

P. Kesornkeaw, K. Lertrat and B. Suriharn

Four cycles of modified mass selection for prolificacy in Tein Luang Nong Bua population of small ear waxy corn at low and high population densities (62,500 and 125,000 plants ha⁻¹) were completed in 2006. The initial population and eight improved populations were evaluated at two planting densities. The objectives were to evaluate the responses of these populations to population density and to estimate selection responses of improved populations for agronomic characters and ear traits. Number of ears per plant increased from 1.75 at cycle 0 to 1.84 at cycle 4 with average rates of gain per cycle of 0.03 ears per plants at low planting density. At high planting density, the average ears per plant increased from 1.75 at cycle 0 to 1.99 at cycles 4 with average rates of gain per cycle of 0.05 ears per plants. Mass selection at high population density resulted in higher response than the one at low population density (increased by 0.07 vs. 0.05 and 0.03 vs. 0.02 ears per plant cycle⁻¹ for low and high planting densities, respectively). Correlated response to selection was observed in both low and high planting densities for plant high (2.9** and 2.8**), ear height (b = 2.3 * and 2.5*), days to tasseling (b = 0.48* and 0.53*) and days to silking (0.53* and 0.41*). It could be concluded that mass selection under both high and low plant densities could increase number of ears and selection under high plant density was more effective than under low plant density. (*Asian Journal of Plant Sciences* 8 (6): 425-432, 2009; *doi*: 10.3923/ajps.2009.425.432)

Effect of Genotypes and Pre-Sowing Treatments on Seed Germination Behavior of *Jatropha*

A.K.M.A. Islam, N. Anuar and Z. Yaakob

The objective of the study was to explore the effects of pre-sowing seed treatments on germination behaviour and to assess the possibilities of increasing the germination rate of *Jatropha curcas*. Seeds of twenty *Jatropha* accessions obtained from seven different sources were subjected to three pre-sowing

treatments viz., control (T_0): unsoaked seeds directly sown in the polybag and apply water up to saturation; T_1 : seed placed on filter paper in the petridish and moistened once with the water; and T_2 : seeds kept under stone sand and moistened once with the water. Seeds in T_1 and T_2 were kept for 72 h before sown in the polybag. The study was conducted in the Glass House of Plant Biotechnology Laboratory, Universiti Kebangsaan Malaysia. Study revealed that pre-sowing treatments significantly ($p < 0.01$) enhanced seed germination parameters of *Jatropha*. Seed germination started 5 days after sowing and continued up to 12 days. The highest germination percentage (95.85%) was observed in T_2 and 100% germination was observed in the genotypes viz., UKM-JC-011, UKM-JC-012, UKM-JC-014, UKM-JC-016 and UKM-JC-020 in T_1 and T_2 . None of the genotypes showed 100% germination in T_0 . The highest Germination Index (GI) and Seedling Vigor Index (SVI) was found in T_2 and the lowest in T_0 . T_2 was found more effective in respect to faster germination, high germination percentage, germination index, seedling vigor index, speed and energy of germination. Five accessions viz., UKM-JC-012, UKM-JC-014, UKM-JC-016, UKM-JC-017 and UKM-JC-019 were found suitable in all the treatments including control. (*Asian Journal of Plant Sciences* 8 (6): 433-439, 2009; doi: 10.3923/ajps.2009.433.439)

Effects of *Eucalyptus* Allelopathy on Growth Characters and Antioxidant Enzymes Activity in Phalaris Weed

M. Niakan and K. Saberi

In this study, different amounts of aqueous extracts [0, 5, 15 and 30% (v/v)] and decompose of *Eucalyptus* leaves [(0, 3 and 6% (w/w))] were applied to *Phalaris* in pot culture and evaluated on growth parameters and antioxidant enzymes activity. The results showed that most of the growth parameters of *phalaris* were decreased when exposed to different amounts of decompose and water extracts of *Eucalyptus* leaves, especially in the leaf decompose. Also, antioxidant enzymes activity in root and shoot of *Phalaris* were affected by aqueous extracts and decompose of *Eucalyptus* leaves. The findings indicated that decompose of *Eucalyptus* leaves decreased catalase activity and increased ascorbate activity in root and shoot of *Phalaris* in comparison to control while aqueous extract of *Eucalyptus* leaves significant raised ascorbate peroxidase in *Phalaris* root. Activity of other enzymes such as polyphenol oxidase and peroxidase in *Phalaris* affected less aqueous extracts and decompose of *Eucalyptus* leaves. (*Asian Journal of Plant Sciences* 8 (6): 440-446, 2009; doi: 10.3923/ajps.2009.440.446)

Growth and Physiological Responses of *Asplenium nidus* to Water Stress

N.A. Ainuddin and D.A. Nur Najwa

Pot experiment conducted in the nursery of Faculty of Forestry, University Putra Malaysia during the periods from May to August, 20006 to investigate the effect of water stress on *Asplenium nidus* growth performance, transpiration rate and chlorophyll content in fronds. The plants were subjected to five water stress levels; control-watered every day, T₁-watered every three days, T₂-watered every seven days, T₃-watered every fourteen days and T₄-suspended without watering. Growth parameters were measured every week for a period of sixteen weeks. At the end of experiment, transpiration rate and chlorophyll content were measured as well as dry matter of plants. The results showed that levels of watering did not significantly affect all growth and physiological parameters of *Asplenium nidus* except T₄ which decreased all growth parameter and some physiological responses. T₁ had the highest dry matter production. The plants allocated more growth to the shoot under optimum conditions but more growth to the root under stress conditions. This plant was able to adapt and survive without watering for 16 weeks and demonstrate that it can survive in water limited condition. (*Asian Journal of Plant Sciences* 8 (6): 447-450, 2009; doi: 10.3923/ajps.2009.447.450)

A Cheap Automatic Tractor's Driver Assistant System

E. Seidi, H.R. Ghassemzadeh and A. Salimi

The purpose of this study is to develop appropriate guiding system based on this method. In the proposed system there is a soil-engaging sensing arm to follow a furrow made in previous pass and firstly by driver. This system is a mechanical guidance system as an aid to manual steering. The driver would make the first pass and headland turnings. During subsequent passes the driver will be free to concentrate on engine speed, Ploughing depth, etc., whilst the self steering device maintains the tractor in correct pass relative to the previous furrow. A sensor attached to the tractor carried a pivoted furrow follower arm which projected between the front wheels of tractor and parallel to the furrow. Through a series of linkages the movement of furrow follower was transferred to an angle sensor. It produces an appropriate signal for controlling the steering wheels. The accuracy achieved was approximately 9 cm. (*Asian Journal of Plant Sciences* 8 (6): 451-454, 2009; doi: 10.3923/ajps.2009.451.454)

Revision of Study of *Typha* Genus: Three New Records Species of the Genus *Typha* (Typhaceae) in Iran and Their Micromorphological Pollen and Capsule Studies

S.M.M. Hamdi, M. Assadi and M. Ebadi

Typha genus belonging to Typhaceae family contained 12 species has been reported in Iran. This genus is one of the most systematically problematic identification. The main purpose of this study is to analyze palynomorphological characters among the member of *Typha* genus and evaluating the efficiency of these features in systematics. A total of 12 species, *Typha* species has been identified. Among them, *Typha angustifolia* L., *Typha caspica* Pobed. and *Typha shuttleworthii* W. Koch and Sonder in W. Koch. were recorded as three new species in the flora of Iran. These species were easily distinguished from its closest relative, *T. latifolia* L. In addition micromorphological characters i.e., capsule, pollen and leaf characters were examined under Scanning Electron Microscope (SEM). Also, *T. persica* was considered as a synonym of *T. shuttleworthii*. Relationships between closed species were discussed and geographical patterns were demonstrated. A diagnostic key to four species of *Typha* distribution in Iran was provided. The results of this study show that SEM studies can be considered as a tool to separate between species in the *Typha* genus. (*Asian Journal of Plant Sciences* 8 (7): 455-464, 2009; doi: 10.3923/ajps.2009.455.464)

Evaluation of Yield and Reproductive Efficiency in Peanut (*Arachis hypogaea* L.) under Different Available Soil Water

P. Songsri, N. Vorasoot, S. Jogloy, T. Kesmala, C. Akkasaeng, A. Patanothai and C.C. Holbrook

The aim of this study was to evaluate the responses to difference in available soil water levels for yield and reproductive characters of peanut genotypes and relate these responses to pod yield under drought conditions. Eleven peanut genotypes were tested under three soil moisture levels (Field Capacity (FC), 2/3 available soil water (AW) and 1/3AW). Data were recorded for total number of flowers, pegs (reproductive sinks; RSs), immature pods and mature pods per plant, number of seeds per pod, 100-seed weight and pod yield at harvest. Drought at mild and severe levels significantly reduced Harvest Index (HI), yield components and reproductive developmental characters and the reductions were most substantial for pod yield with increasing moisture stress. High pod yield under drought conditions in ICGV 98300 was caused by high potential yield and low yield

reduction, whereas high pod yield in ICGV 98324 was due to low pod yield reduction. High HI and numbers of mature pods are advantageous and necessary for high yield under drought conditions. High conversion of RSs to total pods and conversion of flowers to mature pods were the most important factors contributing to high pod yield under mild drought (2/3 AW) and severe drought (1/3 AW), respectively. Tifton 8 showed the lowest pod yield and poor seed filling under well-watered and droughts conditions. (*Asian Journal of Plant Sciences* 8 (7): 465-473, 2009; *doi*: 10.3923/ajps.2009.465.473)

A Study of the Impact of Pruning on the Growth and Vigority of the Hand-Planted-Haloxylon Trees in Kerman, Iran

N. Arabzadeh, R.A. Khavarinejad, Sayed F. Emadian and H. Heydari-Sharifabad

Pruning and reaping different quantities ($P_{1,5}$) of air biomass of the haloxylon trees were studied in two different haloxylon planted areas from the viewpoint of vigority. It was done within the format of the design of fully random blocks with five treatments (pruning from the 10 cm over the collar, pruning 150 cm of the top branches, pruning 100 cm of the top branches, pruning 50 cm of the top branches and control) and four repetitions as possible ways to remove wilting state, dying status and revive the vigor condition of hand-planted shrubs. The index of $VI = H (CD) a^{-1}$ was accepted out of many quantitative indexes as the symbol of vigority (quality) which could show the vigorous quality in the form of a quantitative quantity after testing in hand-planted shrubs of Kerman Province. The average of this index in each of the three germinating conditions (vigorous, wilting and dying) was 1370, 780 and 280, respectively. The statistical studies showed that there was a significant difference among its quantities in different degrees of vigority. In other words, the quantities of this index, in addition to the size of growth showed its quality (the vigority degree) as well. The analysis of the data in LSD method during a 5-year research showed that the impact of P_1 and P_2 on the growth of trees and also VI in both regions were significant. The results showed that the intensive prunings are able to increase the growth of wilting haloxylon and rejuvenate their vigority and freshness. (*Asian Journal of Plant Sciences* 8 (7): 474-482, 2009; *doi*: 10.3923/ajps.2009.474.482)

Evaluation and Selection of Suitable Red Pepper (*Capsicum annuum* var. *conoides* Mill.) Types in Turkey

A. Balkaya and O. Karaağaç

This study was conducted in order to select valuable genetic resources of red conic pepper (*Capsicum annuum* var. *conoides* Mill.) in Bafra plain situated on

Black Sea Region of Turkey during 2003 and 2005. Fifty six red pepper populations were collected from different eco-geographical areas in the research region. All native red pepper genotypes were examined with respect to morphological characteristics. Ranking method was used for selecting superior types. The results of ranking method revealed twenty two superior types. Research results also showed that all populations had 11.2-19.2 cm fruit length, 4.8-7.2 cm fruit width and 4.3-5.8 mm for flesh thickness. Fruit colours of selected types were in red and dark red tones. In the majority of populations harvest time occurred at 105 days. On the other hand, the genotypes exhibited a range of 653.9-1415.5 g for the total fruit weight plants⁻¹, 7.2-13.5 for the fruit number plant⁻¹, 53.0-155.0 mg/100 g for ascorbic acid, 5.2-8.0% for total soluble solids and 8.0-11.9% for total dry weight. At the end of this study, 12 types were selected as being promising for further breeding efforts. (*Asian Journal of Plant Sciences* 8 (7): 483-488, 2009; doi: 10.3923/ajps.2009.483.488)

Effect of Treated Municipal Wastewater on Forage Yield, Quantitative and Qualitative Properties of Sorghum (*S. bicolor* Speed feed)

M. Galavi, A. Jalali, S.R. Mousavi and H. Galavi

This study was carried out to investigate the effect of treated wastewater on yield quantitative and qualitative properties in fresh forage of sorghum. The experiment was conducted at the University of Zabol in Iran during 2007 growing season by using a randomized complete block design and four replications. The treatments were managed for irrigation; with well water during entire period of growing season as control (T₁); well water during entire period of growing season along with NPK (T₂); wastewater during the first half of growing season (T₃); wastewater during the second half of growing season (T₄); wastewater and well water alternately (T₅) and wastewater during entire period of growing season (T₆). Results showed irrigation with wastewater lead to significant increase ($p \leq 0.01$) on total yield, leaf fresh and dry weight, stem fresh and dry weight, stem diameter and leaf number in plant based on Duncan test for comparing, maximum yield (13 ton ha⁻¹) was obtained by irrigation with wastewater and well water alternately, also significant increase in forage qualitative indexes such as WSC, CP, ASH and significant decrease in NDF and ADF. Irrigation with wastewater and well water alternately has shown lower NDF, ADF and favorite CP in comparison with usage of wastewater during the whole growth period. (*Asian Journal of Plant Sciences* 8 (7): 489-494, 2009; doi: 10.3923/ajps.2009.489.494)

Chemical Composition and Antimicrobial Activity of Essential Oil of *Genista numidica* Spach. and *G. saharae* Coss et Dur

T. Lograda, A.N. Chaker, P. Chalard, M. Ramdani, J.C. Chalchat, H. Silini and G. Figueredo

The hydrodistilled oils from the aerial parts of *Genista numidica* and *G. saharae*, which are endemic to Algeria, were analyzed by Gas Chromatography-Mass Spectrometry (GC-MS). Sixty nine compounds in the oil of *G. numidica* representing 87% of the total oil and 58 compounds of *G. saharae*, representing 91% of the total oil were identified. The analysis showed that the main constituents of the essential oils are rich in fatty acid. The major constituent are lauric acid (9.1-8.4%), myristic acid (13.5-14.5%), palmitic acid (15.3-32.3%) and linoleic acid (0-2.4%). The effects of these oils on the growth of *Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 27853) and *Staphylococcus aureus* (ATCC 25923) were investigated by the diffusion method. The oils showed no significant antibacterial activities. (*Asian Journal of Plant Sciences* 8 (7): 495-499, 2009; doi: 10.3923/ajps.2009.495.499)

Sodium, Potassium and Sulphate Composition in Some Seaweeds Occurring along the Coast of Gulf of Mannar, India

S.R. Sivakumar and K. Arunkumar

Minerals such as sodium (Na^+), potassium (K^+) and sulphate were analyzed in red, brown and green abundant seaweeds found along the Coast of Gulf of Mannar, India, during July 2005. A high mean amount of Na^+ was recorded in Chlorophyceae followed by Rhodophyceae and Phaeophyceae. The mean value of K^+ in the brown and red algae were higher when compared to green seaweeds. A less Na^+/K^+ ratio indicated high K^+ and low Na^+ in brown and red algae and a high Na^+/K^+ ratio in green seaweeds indicated high Na^+ and low K^+ . The sulphate content was variable in the algae studied; the maximum concentration was found in red alga *Grateloupia lithophila* (162.8 mg g^{-1} alga dry wt.) and minimum in brown alga *Chnoospora implexa* (0.88 mg g^{-1} alga dry wt.). (*Asian Journal of Plant Sciences* 8 (7): 500-504, 2009; doi: 10.3923/ajps.2009.500.504)

Nano-Silver Particles Eliminate the *in vitro* Contaminations of Olive ‘Mission’ Explants

A.A. Rostami and A. Shahsavari

Olive has been cultivated from ancient times. The traditional propagation methods of olive are laborious and with low efficiency. Now, *in vitro* techniques are an alternative for mass propagation of the species. Establishing a sterile culture is the most challenging step of plant tissue culture process. This study was conducted to evaluate the potential of nano-silver for elimination of contaminations in olive Mission single node explants on Murashige and Skoog half strength (MS/2) medium. Thirty days after culture, the percentages of infected and developed explants were calculated. The results demonstrated that 10% Clorox for 10 min after 70% ethanol for 1 min may be used for surface sterilization of olive explants. Nano-silver used as supplementary disinfectant treatments and microcuttings were submerged into various nano-silver solutions or nano-silver was added to the media. Submergence of microcuttings into various nano-silver solutions was effective to control the internal contaminations, but it also caused severe injuries to the explants. Adding nanosilver (4 mg L⁻¹) to media was fully effective to control explants internal contaminations and no harmful effects were observed on explants and their growth. In conclusion, using very low concentrations of nano-silver as a disinfecting agent in plants tissue culture media is recommended. (*Asian Journal of Plant Sciences* 8 (7): 505-509, 2009; doi: 10.3923/ajps.2009.505.509)

Suitability of Locally Available Substrates for Oyster Mushroom (*Pleurotus ostreatus*) Cultivation in Kenya

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This study aimed at evaluating the suitability of selected substrates for mushroom production. Ten different substrates namely water hyacinth (*Eichhornia crassipes*), maize cobs (*Zea mays*), coconut fibre (*Cocos nucifera*), finger millet straw (*Seteria microcheata*), banana fibre (*Musa* sp.), sawdust (*Eucalyptus* sp.), rice straw (*Oryza sativa*) bean straw (*Phaseolus vulgaris*) and wheat straw (*Triticum aestivum*) were tested for their suitability in mushroom production. Plastic bags were filled with 250 g of substrate and arranged in a randomized complete block design. The substrates had a significant ($p \leq 0.05$) effect on days to pinning, number of caps and biological efficiency. Compared to the control,

which pinned at 28 days, maize cobs, sawdust and coconut fiber had short pinning durations of 19, 22 and 23 days, respectively. With the exception of sawdust, water hyacinth and maize cobs, the rest of the organic substrates significantly increased the marketable caps of the oyster mushroom. The straws, namely, bean, rice, finger millet and wheat had the highest biological efficiency in decreasing order of 106, 92, 85 and 77%, respectively. Stipe length was longest in oyster mushroom grown on bean straw, followed by finger millet straw, maize cobs, banana fiber and shortest in sawdust. Mushroom yield was, 80, 78, 76, 73 and 68%, higher in bean straw, rice straw, millet straw, wheat straw and banana fibre treatment compared to the control. Mushroom yields on sawdust were 60% lower than the control. In descending order of suitability bean, rice, finger millet and wheat straws can be recommended for oyster mushroom production. (*Asian Journal of Plant Sciences* 8 (7): 510-514, 2009; doi: 10.3923/ajps.2009.510.514)

Effect of Different Waterlogging Regimes on Growth, Some Yield and Roots Development Parameters in Three Fiber Crops (*Hibiscus cannabinus* L., *Hibiscus sabdariffa* L. and *Corchorus olitorius* L.)

T. Changdee, A. Polthanee, C. Akkasaeng and S. Morita

The objective of this study was to investigate the effect of different waterlogging regimes on growth, yield and roots development in three fiber crops. Three fiber crops kenaf (*Hibiscus cannabinus* L.), roselle (*Hibiscus sabdariffa* L.) and jute (*Corchorus olitorius* L.) were subjected to waterlogging for 45, 60, 75, 90 and 105 days, as well as a well-drained subject (control). The waterlogging regimes had a significant effect on plant height, stem diameter, leaf area, biomass production, root growth and aerenchyma tissue formation. The crops subjected to waterlogging for longer periods were more affected in their growth characteristics: *H. cannabinus* had a higher plant height, stem diameter, leaf area, biomass production and root growth less than *H. sabdariffa* and *C. olitorius*. Aerenchyma tissue developed in adventitious roots of three fiber crops species. The fiber crops subjected to waterlogging regimes decreased fiber yield by 11.9-51.2% compared to the control. *H. cannabinus* produced the highest fiber yield after 45 days of waterlogging duration. This results is due to the higher growth and roots development of *H. cannabinus* than the other two fiber crops. (*Asian Journal of Plant Sciences* 8 (8): 515-525, 2009; doi: 10.3923/ajps.2009.515.525)

Four Novel Ustilaginomycetous Anamorphic Yeast Species Isolated as Endophytes from the Medicinal Plant *Hyoscyamus muticus*

F.F. Abdel-Motaal, S.A. El-Zayat, Y. Kosaka, M.A. El-Sayed, M.S.M. Nassar and Shin-ichi Ito

Eleven isolates of basidiomycetous yeast were obtained from *Hyoscyamus muticus* plants as endophytes; they were observed to comprise four *Pseudozyma* species based on morphological and physiological analyses. Molecular taxonomic analysis based on nucleotide sequences of the D1/D2 domain of the large subunit ribosomal RNA gene (D1/D2), internal transcribed spacer region of the rRNA gene (ITS) and mitochondrial rRNA genes (both large and small subunits) revealed that the four isolates represented distinct species and formed a cluster with *Macalpinomyces ericachnes* and *Moesziomyces eriocauli* (Ustilaginaceae). D1/D2 and ITS sequence analyses also indicated that the four isolates were genetically distinct from all known *Pseudozyma* species, suggesting that the isolates belonged to four new species. (*Asian Journal of Plant Sciences* 8 (8): 526-535, 2009; doi: 10.3923/ajps.2009.526.535)

The Effect of Morphactin (Methyl 2-Chloro-9-hydroxyfluorene-9-carboxylate) on the Growth and Anatomical Features in Soybean (*Glycine max* (L). Merrill) Cultivar

Yasser M. Awad, A-G.I.O. Baz, Mohamed M. Sakr and Yong Sik OK

The objective of this research was to evaluate the effects of morphactin, on the growth and anatomical features of soybean plants (*Glycine max* L. Merrill) cv. Crawford. Field experiments were conducted under different irrigation regimes (every 5 and 10 days) on soybeans (*Glycine max* L. Merrill) that were planted in a newly reclaimed sandy soil at the Experimental Farm at Suez Canal University, Egypt during seasons of 1998 and 1999. Different concentrations of the morphactin (0, 50 and 200 mg L⁻¹) were added at 40 days after sowing by foliar application. The morphactin treatments significantly decreased the plant height (14.88 and 21.44% inhibition of stem elongation under the two irrigation regimes, respectively), while they increased the number of branches. The pod number plant⁻¹, seed number plant⁻¹, dry weight (g), nodule number plant⁻¹, reducing

sugar content (mg g^{-1} DW) and total phenols (mg g^{-1} DW) increased significantly in response to morphactin treatment at 200 mg L^{-1} . Similarly, the thickness of the midrib, mesophyll, vascular bundle, xylem, cambium + phloem and xylem vessel in the main vascular bundle increased in response to treatment with morphactin at 200 mg L^{-1} . Low irrigation regime (every 10 days) had adverse effect on the growth and anatomical features of soybean. Overall, it is recommended that 200 mg L^{-1} morphactin can be used for the stable production of soybean (*Glycine max* L. Merrill) in newly reclaimed sandy soils in Egypt. (*Asian Journal of Plant Sciences* 8 (8): 536-543, 2009; doi: 10.3923/ajps.2009.536.543)

Molecular Characterization of a Galactose-Binding Lectin from *Momordica charantia* Seeds and Its Expression in Tobacco Cells

H. Tanaka, J. Toyama and R. Akashi

This study examines the function and genetic structure of *Momordica charantia* lectin. A galactose-binding lectin (MCL1) was purified from *M. charantia* seeds. The MCL1 showed highest hemagglutinating activity toward human type-O(H) erythrocytes followed by A, B and O_m^h (para-Bombay phenotype, also known as H-deficient secretor) erythrocytes. Moreover, we observed that MCL1 inhibited the cell-free synthesis of luciferase in a rabbit reticulocyte lysate system. The N-terminal amino acid sequence of purified MCL1 was identified and used to design degenerate oligonucleotide primers. The 3' and 5' ends of the gene coding for this protein were amplified by rapid amplification of cDNA ends, cloned and sequenced. The coding region (1641 bp, 547 amino acid residues) consisted of a 23 amino acid N-terminal signal sequence preceding an A-chain of 263 amino acid residues encoding a ribosome-inactivating protein that was joined to the B-chain of 261 amino acid residues encoding a lectin. The transcript was detected only in embryos, but hemagglutinating activity was detected both in embryos and cotyledons. These results suggest that gene expression occurred only during embryogenesis and the product accumulated in embryos and cotyledons. The *MCL1* was expressed in tobacco BY-2 cells and the supernatant fluid of disrupted cells showed higher hemagglutinating activity toward human type-O(H) erythrocyte than the other tested erythrocytes. Thus, transgenic tobacco suspension culture cells harboring the cloned cDNA encoding the lectin purified from *M. charantia* are expected to be useful for the production of MCL1. (*Asian Journal of Plant Sciences* 8 (8): 544-550, 2009; doi: 10.3923/ajps.2009.544.550)

Effects of Sub-Inhibitory Concentrations of *Myrtus communis* Leave Extracts on the Induction of Free Radicals in *Staphylococcus aureus*; A Possible Mechanism for the Antibacterial Action

A. Gholamhoseinian Najar, S. Mansouri and S. Rahighi

Myrtus communis L. (Myriaceae) has been reported to have antibacterial activity against *Staphylococcus aureus*. However, the mechanism of antibacterial activity of this medicinal herb is not so clear. The leaves of *M. communis* were extracted with chloroform, ethyl acetate and methanol successively and then Total Oligomeric Flavonoids (TOF) were obtained by applying precipitation method. Minimal Inhibitory Concentration (MIC) against *Staphylococcus aureus* (NTCT 8530) was determined by agar dilution method. Sub MIC (SIC) and 0.1 SIC of different extracts were used for the experiments. Bacteria grown with or without the extracts were lysed with lysophosphatin. The activities of catalase and superoxide dismutase (SOD) were measured by using a spectrophotometric method. Malonaldehyde (MDA) was determined by thiobarbituric acid method and the total antioxidant capacity was measured by colorimetry. Specific activity of SOD in bacteria treated by TOF, ethyl acetate, chloroform and methanol extracts at SIC were found to be 0.41, 0.42, 0.38 and 0.51, respectively, compared to 0.93 U mg⁻¹ for the control sample, showing a significant decrease. Catalase specific activity of bacteria in media containing TOF, ethyl acetate, chloroform and methanol extracts were 50.55, 11.97, 46.66 and 46.67 U mg⁻¹, respectively, which showed significant reduction compared to their controls (88.82 U mg⁻¹, p<0.001). All four extracts of *Myrtus communis* leaves caused a decrease in lipid peroxidation as MDA formation and the total antioxidant activity in *S. aureus* (p<0.001). It is concluded that the antibacterial effect of *Myrtus communis* on *S. aureus* is partly due to induction of free radicals. Ethyl acetate extract showed the highest antibacterial effect comparing to all others. The effects of extracts on free radicals were dose dependent. (*Asian Journal of Plant Sciences* 8 (8): 551-556, 2009; doi: 10.3923/ajps.2009.551.556)

Variation in Seed Germination, Seedling Growth, Nucleic Acid and Biochemical Component in Canola (*Brassica nupus* L.) Under Salinity Stress

Mostafa Heidari

A laboratorial study was carried out to investigate the effect of NaCl on seed germination, seedling growth, proline concentration and deoxyribonuclease

(DNase II) in canola. Five canola genotypes (Hyola308, Hyola401, Hyola60, Optlon50 and RGS003), were grown in petri dishes containing $S_1 = 0$, $S_2 = 100$, $S_3 = 200$ and $S_4 = 300$ mM NaCl in controlled environment. Results indicated that increased salinity caused a significant reduction in germination. Increase salt concentration also affected the early seedling growth and proline concentration in root and shoot tissues. Among the genotypes, Hyola60 appeared to be more tolerant at germination stage and accumulate the highest proline in the root and shoot as a result of salt stress. Among the genotypes, RGS003 had the highest the activity of DNase II in all of salinity treatments but more sensitive at 300 mM NaCl in germination stage then others. (*Asian Journal of Plant Sciences* 8 (8): 557-561, 2009; doi: 10.3923/ajps.2009.557.561)

The Effect of Air Pollution on Some Morphological and Biochemical Factors of *Callistemon citrinus* in Petrochemical Zone in South of Iran

S.M. Seyyednejad, M. Niknejad and M. Yusefi

In this study the main purpose is to study on some biological factors of a deciduous tree species *Callistemon citrinus* in polluted and high temperature condition in South of Iran. The location was selected because of high rate of industrial pollution that is caused by petrochemical companies. *Callistemon citrinus*, family Mirtaceae, is a kind of evergreen tree with alternate, linear leaf. The type and margin of leaves are simple and entire, round brown fruits with hard or dry cover and red flowers. The common name of *C. citrinus* is red bottlebrush that is describe it's flowers shape. The concentrations of chlorophyll A, B total chlorophyll, carotenoid, soluble sugar, proline and morphological effects were examined in the leaves of tree species, growing in polluted area as compare to unpolluted condition. In the polluted regions higher concentrations of soluble carbohydrate, proline, chlorophyll A, B, carotenoid were observed in comparison with trees in the unpolluted regions. The morphological characters affected by stress of pollution. Characters such as leaf area, length and breadth of blade, showed decrease. (*Asian Journal of Plant Sciences* 8 (8): 562-565, 2009; doi: 10.3923/ajps.2009.562.565)

Effect of Various Substrates on Linear Mycelial Growth and Fructification of *Volvariella diplasia*

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In the present study, effect of different substrates on mycelial growth and yield of *Volvariella diplasia* was evaluated. *Volvariella diplasia*, the paddy straw

mushroom, is worldwide one of the most widely cultivated mushrooms. Cereals are the most popular basal ingredient used in synthetic substrate formulation for producing paddy straw mushroom spawn. However, the present work evaluates the best and cheap substrate for spawn culture and mushroom production. Paddy straw mushroom was cultivated on various types of cereals (Wheat, Maize, Ragi, Jowar, Bajra) and pulses (Bengal gram, Green gram). Cultivation on Bajra resulted in significantly faster mycelial growth as compared to other substrates followed by Jowar. With respect to fructification, culture on wheat shows highest production. The lowest biological and economical yields were found when the culture was on bajra. Biological efficiency and biological yield were highest with culture on wheat. The above findings reveal an opportunity for commercial implication of paddy straw mushroom especially *Volvariella diplasia* for utilization of different feasible and cheap substrates. (*Asian Journal of Plant Sciences* 8 (8): 566-569, 2009; *doi*: 10.3923/ajps.2009.566.569)

Quality Evaluation of Gliadins from Zhengmai 9023×99E18 in Wheat

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Although it is known that the compositions of gliadins have effects on bread-making quality of wheat, it is still not clear which gliadins confer improved bread-making quality and whether those gliadins interact with glutenins and other gliadins. Using a hard red winter wheat line 99E18 and zhengmai9023 with good bread-making quality as well as their progeny we identified gliadins associated with the bread-making quality. SDS-PAGE and APAGE method were used to analyze the gliadin composition and HMW-glutenin subunits of 45 wheat inbred lines and their relationships to bread-making quality were conducted. The significance of difference was calculated between the omega gliadins and bread-making quality. The positive and negative effects have been detected between the particular gliadin bands and baking quality. Thus, gliadin could be used as parameters when breeding for bread-making quality. (*Journal of Plant Sciences* 4 (1): 1-9, 2009; *doi*: 10.3923/jps.2009.1.9)

The Rooting Performance of Shea (*Vitellaria paradoxa* C.F. Gaertn) Cuttings Leached in Water and Application of Rooting Hormone in Different Media

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In order to improve the rooting performance of shea stem cuttings to enhance the establishment of shea plantation, an investigation was carried out in 2003/2004 at

the Cocoa Research Institute of Ghana Substation, Bole in a polythene propagator. The propagating structures for the experiment were kept under a shade net (50% shade) to create a microclimate for the cuttings. The treatments employed were leaching, different growth media and hormone application. Rejuvenated (coppiced cuttings) shoots that were not leached (not dipped in water) gave significantly higher rooting than the leached cuttings while Seradix 3 powder applied cuttings produced significantly higher ($p < 0.05$) rooting than the control. Significantly high in number, more developed and longer roots per cutting were recorded for the rice husk medium than the sand and sand+top soil (1:1) media. The biochemical analysis significantly recorded high levels of sugar and phenol for cuttings that were not leached in water. The results of this study demonstrated that rice husk medium was the best for rooting shea cuttings. (*Journal of Plant Sciences*, 4 (1): 10-14, 2009; doi: 10.3923/jps.2009.10.14)

Antioxidant Activity of Isolated Phytoconstituents from *Casuarina equisetifolia* Frost (Casuarinaceae)

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The aim of the present study was to isolate the active constituents responsible for antioxidant activity. Radical scavenging activities of chromatographically isolated compounds from methanolic extracts of wood, bark, fruit and leaf were measured by the 1, 1-Diphenyl-2- Picrylhydrazyl (DPPH) method. The structures of isolated compounds were confirmed by spectroscopic techniques comprising of UV, IR, ^{13}C NMR, P-NMR, Mass spectral and Co-TLC studies. The compound ANA 01, ANA 02 and ANA 04 were isolated from bark and confirmed as catechin, ellagic acid and gallic acid, respectively. The leaf extract resulted in separation of compounds ANA 03 (quercetin). The free radical scavenging activity of the different isolated compounds from methanolic extracts of *Casuarina equisetifolia* increased in a concentration dependent manner. ANA 04 (gallic acid) exhibited very strong antioxidant activity and when compared to ANA 01 (catechin), ANA02 (ellagic acid), ANA 03 (quercetin) and ANA05 (lupeol). This study suggests that the *Casuarina equisetifolia* could be pharmaceutically exploited for antioxidant properties. (*Journal of Plant Sciences*, 4 (1): 15-20, 2009; doi: 10.3923/jps.2009.15.20)

Development of a Low Cost Micropropagation Technology for an Endangered Medicinal Herb (*Picrorhiza kurroa*) of North-Western Himalayas

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The current study was undertaken with the objective that tissue culture conditions need to be optimized for obtaining vigorous shoot growth coupled with modifications in the nutrient medium so as to reduce the cost of nutrient medium. Axillary shoot tips cultured on MS +IBA (2 mg L⁻¹) + KN (3 mg L⁻¹) + sucrose 3% (w/v) + agar-agar 0.8% (w/v) was the best medium for multiple shoot formation with 86.3% shoot apices forming multiple shoots. The sucrose was replaced with table sugar and agar-agar was omitted completely. Out of 6 low-cost media combinations tested, MS liquid medium supplemented with Indole-3-Butyric Acid (IBA) (2 mg L⁻¹) + kinetin (KN) (3 mg L⁻¹) + table sugar 3% (w/v) was found to be the best with 27 shoots/explant. Seventy percent shoots formed roots on half strength MS salts supplemented with IBA (3 mg L⁻¹) + table sugar 3% (w/v) + agar-agar with an average of 5.6 roots per shoot. The study has resulted in the identification of a low-cost medium combination for rapid multiplication of *P. kurroa* with a potential that the technology can be up-scaled to a large-scale production. (*Journal of Plant Sciences* 4 (2): 21-31, 2009; doi: 10.3923/jps.2009.21.31)

Effect of Signal Molecules and Hormones on the Expression of Protein Kinase Gene *OrMKK1* in Rice

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A putative protein kinase gene was isolated from *Oryza rufipogon* using the *OsMKK1* as template for primer synthesis. This gene was used to analyse the involvement of signal molecules and hormones in signal transduction of mitogen-activated protein kinase. The 352 amino acids long MAPK has a molecular weight of 37 kDa and a pI value of 6.1. The gene sequence contained a dual-phosphorylation activation motif TDY (Thr-Asp-Tyr) and four activity domains (catalytic loop, activation loop, ATP binding site and substrate binding site). The 5'UTR of the gene was also analysed and was shown to contain the MYBCORE, ERE, GT-1 and GATA box, all of which have a role to play in MAPK function. Here we have treated the *OrMKK1* lines with Jasmonic Acid (JA), salicylic acid (SA), ethylene (ET), benzothiadiazole (BTH) and abscisic acid (ABA) to determine the involvement of these molecules and hormones in MAPK

signal transduction. *OrMKK1* gene was induced by JA, SA, BTH and ET but was delayed and weak in ABA. The highest level of expression is seen in JA treated plants. The transcript level of this gene was also studied in various tissues and organs of rice and the results show that the gene is developmentally regulated as clearly seen from the Northern analysis conducted on rice tissues. The results from this study suggest that *OrMKK1* may be activated by signal molecules and hormones and this gene may play a role in the plant defense mechanism. (*Journal of Plant Sciences* 4 (2): 32-42, 2009; **doi**: 10.3923/jps.2009.32.42)

The Effects of Steviol Glycosides Blending Liquid on Seeding Growth and Development in Upland Rice

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Using the method of liquid culture and selecting the variety of Handao502, the effect of Steviol glycosides Blending Liquid (SBL) on seeding growth and development in upland rice had been studied in phytotron. Many indexes were studied including the germination rate of seed, the fresh weight and dry weight, the indexes of physiology and biochemistry in seeding stage. The results indicate that the appropriate treatment of SBL increases the seed germination rate, promotes the growth of shoot and the roots in the seeding stage, increases the fresh weight, dry weight and the ratio of root to shoot, increases the peroxidase (POD) activity, the free proline content and the root vigor, decreases the malondialdehyde (MDA) content. So, proper SBL increases the unsuitable resistance ability in the growth and development of seeding stage in upland rice. This study provides a certain foundation for the high yield cultivation of upland rice. (*Journal of Plant Sciences* 4 (2): 43-48, 2009; **doi**: 10.3923/jps.2009.43.48)