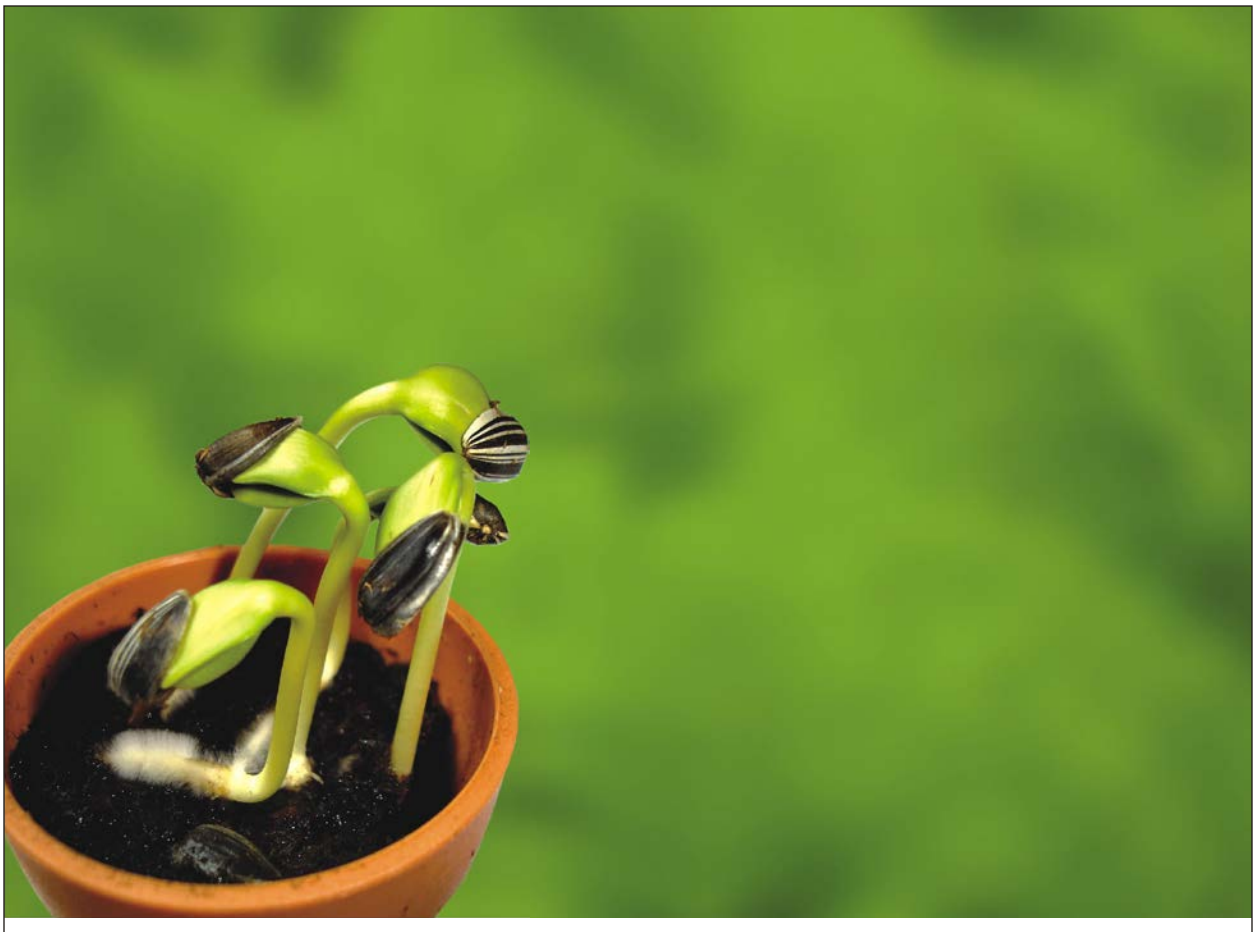

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## A Revised Check-List of the Bryophytes of A4 Square of Turkey

Turan Özdemır

The checklist includes a list of genera, species, subspecies and varieties of A4 square (including Trabzon, Giresun, Rize, Gümüşhane, Bayburt and Artvin regions of Turkey) adopted by Henderson. It consist of 469 taxa of Bryophyta, 2 of them belong to Anthocerotopsida, 95 to the Hepaticopsida and 382 to Bryopsida. The result of the studies done in the study areas 112 taxa (10 Hepaticopsida and 102 Bryopsida) have been added as new record to A4 square from 2000 up to now (September 2008). Of these, 12 taxa (6 Hepaticopsida and 6 Bryopsida) are new to Turkey for A4 square in last ten years. *(International Journal of Botany 5 (1): 1-35, 2009; **doi**: 10.3923/ijb.2009.1.35)*

## Distribution of Flowering Plants and Cyanobacteria in Relation to Soil Characters in Bahariya Oasis, Egypt

I.B.M. Ibraheem and E.A. Al-Sherif

Baharia Oasis in one of the famous Oasses in western desert of Egypt. This study dealt with the distribution of flowering plants and cyanobacteria in the Oasis in relation to each other and to physicochemical characters of soil. Fifty six species of flowering plants and 29 cyanobacterial species were identified in seven different habitats. The data revealed that the flowering plants and algal taxa were controlled by the edaphic factors and physico-chemical characters of the soil. In the present study, both positive and negative correlations between flowering plants and cyanobacterial taxa were obtained confirming the controversial effect of cyanobacterial crust on vascular plants. *(International Journal of Botany 5 (1): 36-46, 2009; **doi**: 10.3923/ijb.2009.36.46)*

## The Distribution of $C_3$ and $C_4$ Photosynthetic Species of the Centrospermeae Along an Altitudinal Gradient in Western Kenya

S. Sikolia, J.C. Onyango, E. Beck and J.I. Kinyamario

Two hundred and seventy eight species of the Centrospermeae were collected at different sites in Western Kenya representing gradients of altitude and aridity.

Climate data were obtained from meteorological research stations. Species were examined for $C_3$ or $C_4$ photosynthesis using the anatomical Kranz syndrome, $\delta^{13}C$ values and carbon dioxide compensation points. $C_4$ photosynthesis is a feature of modern members of dicotyledoneae is of multiple evolutionary origins. It evolved independently in members of the same family and was found in one to several genera and then often only with two to three species. $C_4$ species are concentrated in lowland habitats subjected to high temperature, low precipitation and high evaporation. High $\delta^{13}C$ values is associated with low water availability which is a physiological syndrome and also a feature of saline habitats. The $C_3$ representatives of the Centrospermeae dominate in more moist and colder habitats, especially at higher altitudes. Only a few $C_4$ species occur at high altitudes (3000-4000 m) namely *Sagina gallica*, *Silene abyssinica* and *Melandrium nordiflorum*. The transition zone between $C_3$ and $C_4$-dicot is rather narrow between 1500 to 1700 m and thus much lower than that recorded for the monocots (2000-2200 m). The general pattern of $\delta^{13}C$ values distribution along the altitudinal gradient show that the values of -10.60 to -16.55, -17.75 to -18.87 and -18.89 to -32.42‰ that corresponds to altitudinal ranges, 0-1500, 1550-1700 and 1800-4200 m, respectively. The low altitudes are associated with drought and high temperatures. $C_4$ and $C_3$ dicot species can be intercropped to increase bioproductivity for the betterment of the flora and fauna in the semi-arid and arid ecosystem. $C_4$-species are potential candidates for exploitation in the agroforestry systems especially for long-term management programmes. The present study may also be relevant for better understanding of global change with respect to the diversity of photosynthetic pathways, herbivory and vegetation dynamics. *(International Journal of Botany 5 (1): 47-57, 2009; **doi:** 10.3923/ijb.2009.47.57)*

## The Effects of Aluminum on Fiber and Protein Bound Condensed Tannin, Polyphenols and Some Growth Index in Two *Sorghum* Cultivars

H.A. Malmir, A. Mostajeran, A. Almodares, G. Asghari, A. Afkhami and H. Nassiry-Hachellu

The effect of Al on fiber and protein bound condensed tannin, polyphenols, tannin and some growth index in two cultivars of *Sorghum* (cult. 132 and 552) has been investigated. The medium culture was river sand and peat in 3:1 ratio, respectively. All pots received Hoagland's nutrient solution with and without $AlCl_3$. The first plant samples were obtained 30 day after sowing and the others were obtained each two weeks interval (days, 30, 44, 58, 72, 86, 90, 114 and 128) up to the

end of plant's vegetative growth. Plant dry weight, growth rate and leaf area were measured and then total tannin, fiber and protein bound condensed tannin, total polyphenols in eight successive harvests were compared. The results indicated that the mean growth rate for cultivars 132 and 552 in control plants were 255 and 196 mg/plant/day, respectively and when Al contributed in the growth medium, the mean growth rates were reduced to 224 and 170 mg/plant/day in cultivars 132 and 552, respectively (almost 36% reduction). In average, leaf expansions were 6.4 and 4.5 $cm^2$ $day^{-1}$ in cultivar 132 and 552, respectively and Al significantly decreased ($p<0.001$) the leaf area by 11.3 and 7.1% in cultivar 552 and 132, respectively ($p<0.001$). Al causes to increase the concentration of Protein Bound Condensed Tannin (PBCT) in leaves of two cultivars with different patterns. In cultivar 132, PBCT was accumulated almost in a rate of 0.075 mg $g^{-1}$ DW $day^{-1}$ in plant during growing season. In contrast, in cultivar 552 the amount of PBCT was the same at early stage of growth in plants treated with Al and then increased slightly afterward. Although the root's PBCT were lower in cultivar 552, their amounts were decreased up to the end of growing season. This behavior was completely different in cultivar 132. Adding Al into nutrient media would change the pattern of PBCT in root. The amounts of PBCT in control plants were higher than fiber bound condensed tannin. However the trend was different in different cultivars respect to Al toxicity. Amount of total polyphenols in control plants were higher in cultivar 132 (90.9 mg $g^{-1}$ DW) than cultivar 552 (52.6 mg $g^{-1}$ DW) during growing season however Al has no significant effect on the amount of total polyphenols except at late stage of growth in which Al increased total polyphenols in both cultivars. Total tannin in cultivar 132 was peaked at middle stage of growth and was lower at younger and elder leaves. Al causes to increase the total tannin at elder leaves. *(International Journal of Botany 5 (1): 58-66, 2009; **doi:** 10.3923/ijb.2009.58.66)*

## Carbon Dioxide Compensation Points of Some Dicots of the Centrospermeae Species and Their Ecological Implications for Agroforestry

S. Sikolia, E. Beck and J.C. Onyango

The present studies on carbon dioxide compensation point (Γ) considered species from tropical semi-arid, snowline and saline ecosystems. The aim of the study was to establish the ecological range of the $CO_2$ compensation point of species in the semi-arid/arid, snowline/or saline conditions. Secondly, to determine the effect of biomass on the rate of carbon dioxide assimilation in relation to the ecological efficiency of the $C_3$ and $C_4$ photosynthetic pathways. Four and six-seven week old

plants were used to assimilate carbon dioxide in the gas chamber until a constant reading was attained by Infra Red Gas Analyzer (IRGA). The carbon dioxide uptake concentrations (assimilations) were continuously measured by pumping a stream of the air through a closed gas tight, circuit with IRGA while temperature and light intensity and previous growth conditions were maintained constant. The dry weight of the plant was measured using a digital balance after the experiment. The $CO_2$ compensation points of the $C_4$ plants vary between 8-20 ppm. The $CO_2$ compensation points of the $C_3$ plants vary between 40-60 ppm. The age and biomass of the plant influenced the rate of carbon dioxide assimilation in the $C_4$ species and $C_3$ species. The $C_4$ plant attained the $CO_2$ compensation point faster than $C_3$ plant under the same physiological conditions. The $C_4$ plant photosynthesized below 40 ppm of carbon dioxide concentration. The $C_3$ plant ceased carbon dioxide assimilation below 40 ppm of carbon dioxide concentration. Thus, an ideal ecological canopy set-up should consist of a $C_4$ over storey and a $C_3$ under storey for efficient photosynthetic performance and yield. Potential $C_4$ overstorey species including *Amaranthus* species and *Kochia scoparia*, should be intercropped with potential $C_3$ understorey species like *Chenopodium album* and *Phytolaca dioica* by farmers and horticulturalists in Agriculture. The intercropping practice is economical, viable and apt in agroforestry systems, especially in the semi-arid and saline conditions socialized by nomadic tribes in Kenya. Perkerra irrigation project can act as satellite agroforestry research station, including Kerio valley and Turkana regions. *(International Journal of Botany 5 (1): 67-75, 2009;* ***doi:*** *10.3923/ijb.2009.67.75)*

## Sequence and Expression Analysis of EgSAPK, a Putative Member of the Serine/Threonine Protein Kinases in Oil Palm (*Elaeis guineensis* Jacq.)

Huynh Ky, Le Vinh Thuc, Siew-Eng Ooi, Z. Ishak, P. Namasivayam and S. Napis

In present study, EgSAPK (EU805512), an oil palm transcript coding for a putative SAPK protein kinase, have been molecular characterized. The cDNA for EgSAPK isolated from an oil palm cell suspension culture is 1470 bp in length with a longest Open Reading Frame (ORF) of 963 bp. No translation start codon could be identified so EgSAPK cDNA sequence is lacking the 5'-end. The deduced protein sequence shares 89% identity with the serine/threonine protein kinase SAPK9 from rice (AB125310.1). Real time PCR results showed that the expression levels of EgSAPK varied in different oil palm tissues and the

EgSAPK gene shares a similar expression pattern with the SAPK gene of rice. Furthermore, the transcription of the EgSAPK gene in green embryo, white embryo and embryogenic calli tissues were higher than in non-embryogenic calli tissues. Southern blot analysis showed that the EgSAPK gene might be present as a single copy gene in the oil palm genome. These results suggest that EgSAPK may have a similar function as the SAPK gene of rice and thus can be a candidate marker for oil palm somatic embryogenesis. *(International Journal of Botany 5 (1): 76-84, 2009; **doi**: 10.3923/ijb.2009.76.84)*

## Bryophyte Diversity Within Urban Areas: Case Study of the City of Belgrade (Serbia)

M. Sabovljević and S. Grdović

The bryophyte diversity and urban bryophyte flora of the city of Belgrade was studied. In total 210 taxa were recorded, with 23 hepatics and 187 mosses. Comparing to some other urban areas of Europe, bryophyte diversity of the Belgrade metropolitan belongs among the richest in Europe, however bryophyte are not abundant. Among bryophytes of Belgrade city, there are 14 nationally red-listed species and two internationally threatened. According to the frequency of records, the Belgrade bryophytes are classified to rare, common and spread. Rare species within the urban area are 94, 69 are common to find and only 24 are spread and easy to record in Belgrade wide area. Urban metropolitan areas are different from native but gives various condition in small shelters for rich diversity of small organisms like bryophytes. *(International Journal of Botany 5 (1): 85-92, 2009; **doi**: 10.3923/ijb.2009.85.92)*

## Hybridization and Polyploidy: Cytogenetic Indications for *Hoffmannseggella* (Orchidaceae) Species Evolution

Júlia Yamagishi-Costa and Eliana Regina Forni-Martins

In the present research through chromosome counts utilizing root meristems and immature ovaries and/or observation of meiotic behavior from floral buds, we analysed seven *Hoffmannseggella* species and confirmed the basic number of x = 20. From the seven species analyzed, one presented polyploidy (*H. briegeri*) (Blumensch. ex Pabst) V.P.Castro and Chiron, 2n = 80), one presented both diploid (2n = 40) and polyploid (2n = 80) cytotypes (*H. rupestris* (Lindley) V.P. Castro and Chiron) and the five remaining species presented n = 20/2n = 40

chromosomes. Polyploid species/cytotypes presented aneusomatic root tissues. Meiotic abnormalities, like monovalents, early disjunction of bivalents and putative tetravalents were observed in several species. We suggest that hybridization and polyploidy are, if not the major, at least very important mechanisms for the evolution of species and that these events are probably occurring in the present, possibly being responsible for many taxonomic divergences within the group. *(International Journal of Botany 5 (1): 93-99, 2009; **doi:** 10.3923/ijb.2009.93.99)*

## Compatibility, Growth and Production Potentials of Mustard/Lentil Intercrops

M.M. Rahman, M.A. Awal, A. Amin and M.R. Parvej

An experiment was conducted to analyse the interspecies compatibility and production potentials of mustard and lentil in intercrop association. The experiment comprised four planting systems viz., sole mustard, sole lentil, single row (1:1 i.e., one row of mustard followed by one row of lentil) and double row (1:2 i.e., one row of mustard followed by two rows of lentil) intercropping. The stands height and number of branches (primary and secondary) per plant were maximum and minimum in sole and single row intercropped plants, respectively. Higher leaf area index and total dry matter production was observed in sole cropped mustard or lentil while those were lower in 1:2 intercropped mustard or 1:1 intercropped lentil plants. Maximum seed yield, 1.26 t $ha^{-1}$ (or 1.30 t $ha^{-1}$) was harvested from sole crop of mustard (or lentil) which was about 40 and 48% (or 34 and 12%) higher than that of the mustard (or lentil) yield obtained from single and double row intercrop mixtures, respectively. Combined seed yield from double row mixture was the maximum (1.8 t $ha^{-1}$) and was respectively 11, 30 or 28% higher than that obtained from single row intercropped stands, sole mustard or lentil. Single and double row intercropping systems respectively resulted 25 or 41% increase in land equivalent ratios. Area time equivalency ratio was also increased by about 14 and 31%, respectively for single and double row intercropping systems. The competitive ratio of each population is approached to be unity in both intercropping systems reflecting the proper balance of the natural resources between associated species resulted better yield. The results suggest that mustard and lentil populations are well compatible in intercrop association and 1:2 row ratio mixture would be better for their profitable production. *(International Journal of Botany 5 (1): 100-106, 2009; **doi:** 10.3923/ijb.2009.100.106)*

## Post-Fire Regeneration of a *Pinus brutia* (Pinaceae) Forest in Marmaris National Park, Turkey

Ç. Tavşanoğlu and B. Gürkan

Post-fire recovery of a *Pinus brutia* Ten. forest on ophiolithic rocks was studied in Marmaris National Park, southwestern Turkey. Three study sites burned in different years (1999, 1995 and 1979) and a study site not burned for at least 45 years were studied from September 2000-2001. Although some opportunistic species had established in one-year-old site, species composition had been recovered again in older sites. Change in the plant species cover during early post-fire succession was basically different between seeders and resprouters; cover of the seeders increased, but that of resprouters did not change. Post-fire growing line of *P. brutia* individuals during 22 year period was fitted to a linear regression model ($r^2 = 0.9995$, $p<0.001$). In conclusion, post-fire regeneration of *P. brutia* forests on ophiolithic rocks in Marmaris National Park fits to the general autosuccessional model in Mediterranean Basin and fire is a complementary element for these forest ecosystems. *(International Journal of Botany 5 (1): 107-111, 2009;* ***doi:*** *10.3923/ijb.2009.107.111)*

## Ratooning Potential of Interspecific NERICA Rice Varieties (*Oryza glaberrima*×*Oryza sativa*)

K.A. Sanni, D.K. Ojo, M.A. Adebisi, E.A. Somado, O.J. Ariyo, M. Sie, I. Akintayo, D.D. Tia, S.A. Ogunbayo, B. Cissé, M. Sikirou and M.A. Adekoya

Field experiment was conducted in Deve (6°48 N, 1°47'E, 72 masl) in the Savannah zone of Benin Republic, to examine the increase in grain yield due to ratooning. Eighteen upland interspecific varieties (NERICA1-18) and their *Oryza glaberrima* (CG 14) and one of the *O. sativa* (WAB 56-104) parents were used in a Randomized complete block design with three replications. The first (main) crop was harvested at mass maturity, after which the tillers were hand mowed to stubbles of about 10 cm tall. These were then left without any further input, until the ratooned plants were ready for harvest. The result showed a large variation in the ratoon performance among NERICA, with ratoon ability ranging from 13% (NERICA 2) to 39% (NERICA 14 and 17). Total grain yield (main plus ratoon) was significantly different ($p<0.001$) from that of the main harvest. The maximum total grain yield was 6.14 t $ha^{-1}$ for NERICA 2 followed by NERICA 15 and 11 (6.02 and 6.01 t $ha^{-1}$, respectively). The yield increase of more than 1.5 t $ha^{-1}$ (the average yield of upland rice in Sub-saharan Africa)

recorded in NERICA, with no additional input was very encouraging. This will presumably increase with additional input during ratoon. Therefore, NERICA rice is able to fructify twice, hence farmers can harvest more rice and make more profit. *(International Journal of Botany 5 (1): 112-115, 2009; **doi**: 10.3923/ijb.2009.112.115)*

## Floristic Composition of Lake Al-Asfar, Alahsa, Saudi Arabia

Ashraf M. Youssef, Mohamed A. Al-Fredan and Adel A. Fathi

The vegetation communities of the shores of Lake Al-Asfar; a large salt lake in Al-Hofouf, Al-Hassa, Saudi Arabia; were studied. The aim of the research was to study the relationship between the distribution of vegetation along salt lake shores in relation to soil and climatic conditions. Four distinct lake shore habitats were examined. A total of 72 stands along the study area of the lake were investigated. It was concluded that soil texture, pH, soil moisture content, mineralization as well as the climatic factors were likely to be key factor in determining the distribution of vegetation communities along the shores and habitats of the lake. The study included: list of species and their families, growth forms, frequencies, densities, abundances, recurrence, diversity richness, heterogeneity and evenness in each of the four habitats along the lake. A total of 39 plant species belonging to 20 families were identified from the four studied habitats. More than 61% of the species recorded were perennial shrubs (PSH). Diversity richness indices were 2.02, 2.22, 3.05 and 4.91 in the inundated wet zone (Site I), moist zone (Site II), semi-dry zone (Site III) and arid zone (Site IV), respectively. Heterogeneity was from 2.01-3.10 (Shannon-H') and evenness was 0.89 to 0.98. The heterogeneity in species composition among the sites was moderate indicating that each site has its own unique flora. Those dominant communities occurring on highly and moderate saline soils of the four habitats (I, II, III and IV) along the lake included *Phragmites australis*, *Halocnemum strobilaceum*, *Zygophyllum mandavillei* and *Haloxylon salicornicum*, respectively. *(International Journal of Botany 5 (2): 116-125, 2009; **doi**: 10.3923/ijb.2009.116.125)*

## A Checklist of Lekki Lagoon Diatoms

T.A. Adesalu and D.I. Nwankwo

The diatoms of Lekki lagoon for the first time were studied at monthly intervals for two years (June 2003-May 2005). Two hundred and thirty seven (203 pennate and 34 centric forms) diatom species belonging to 50 genera

were recorded. Among the pennate diatoms, the most frequent species were *Achnanthes conspicua*, *Bachysira follis*, *Bacillaria paradoxa*, *Craticula cuspidata*, *Cymbella ventricosa*, *Decussata placentula*, *Eunotia incisa*, *Frustulia rhomboides*, *Gyrosigma balticum*, *Luticola mutica*, *Nitzschia radiosa*, *Pinnularia biceps*, *P. gibba*, *Placoneis exigua*, *Plagiotropis* sp., *Sellophora pupila* and *Synedra ulna* var. *longissima*. The holoplanktonic forms included *Synedra ulna* (Nitz.) Ehr., *Synedra acus* Kutzing and *Tabellaria fenestrata* (Lyng.) Kutzing. The centrals were ably represented by *Aulacoseira* and its varieties, *Cyclotella* and *Terpsinoe musica*. In this study, fifty new diatoms species were recorded for Lagos lagoon complex while *Aulacoseira herzogii* is new record for Nigeria. Community structure analysis shows a highly diverse environment. *(International Journal of Botany 5 (2): 126-134, 2009; **doi**: 10.3923/ijb.2009.126.134)*

## Effects of Salinity Stress on Growth, Ions Partitioning and Yield of Some Cowpea (*Vigna unguiculata* L. Walp.) Cultivars

Victor Désiré Taffouo, Joseph Kemdem Kouamou, Louis Marie Tchiengue Ngalangue, Bop Alain Nandjou Ndjeudji and Amougou Akoa

In this study, twenty one cowpea cultivars (*Vigna unguiculata* L. Walp.) were tested for their salt tolerance at different degrees of salinity; 0, 50, 100 and 200 mM of NaCl, in both the laboratory and field conditions. In the laboratory, $Na^+$, $K^+$, K/Na ratio, plant height, roots dry weights, stems and leaves were investigated. In the field conditions, yield components (weight of 1000 seeds, number of pods per plant, total chlorophyll and grains yield) were determined in harvesting phase. Results showed that $K^+$ concentration, K/Na ratio, seedlings height and total chlorophyll were significantly decreased by salt solutions, especially by 200 mM and the magnitude of reduction varied according to cultivars. $Na^+$ was significantly increased with increasing NaCl concentrations in all plant organs. Roots dry weights as well as stems and leaves decreased significantly in all cultivars with increasing salinity except in organs of Bambey 21 (V11), IT97K-556-4 (V3) and IT04K-332-1 (V10) cultivars. Under field conditions, the weight of 1000 seeds, the number of pods per plant and grains yield were affected by soil salinity at 50 mM of all cultivars except in Bambey 21, IT97K-556-4 and IT04K-332-1. The results obtained during vegetative growth and harvesting phase suggested that Bambey 21, IT97K-556-4 and IT04K-332-1 cultivars were relatively tolerant to salinity than others. Bambey 21, IT97K-556-4 and IT04K-332-1 cultivars could be grown in environments with varying salinity. *(International Journal of Botany 5 (2): 135-143, 2009; **doi**: 10.3923/ijb.2009.135.143)*

## A Multifunctional Acetyl-CoA Carboxylase Gene Confers Freezing Tolerance in *Arabidopsis thaliana*

Azura Amid and Gareth J. Warren

The *sfr3-1* mutation causes freezing-sensitivity in *Arabidopsis thaliana.* Through mapping, sequencing and transgenic complementation, *sfr3-1* was revealed as a missense mutation in ACC1, which is an essential gene encoding multifunctional acetyl-CoA carboxylase. Suppression of ACC1 expression by RNA interference produced a freezing-sensitive phenotype with some similarity to that of *sfr3-1*. The dCAPS primers and PCR confirmed that *sfr3* gene encodes multifunctional acetyl-CoA carboxylase. Microarray and real-time PCR experiments demonstrated that the expression of ACC1 increase only 1.48 fold in wild-type and 1.35 fold in mutant in response to cold treatment. Studies also suggested that the *sfr3-1* mutation is more likely to be a temperature-sensitive mutation as the *sfr3* mutant cuticle becomes leaky only at low temperature and this was confirmed by cuticular defects analysis. *(International Journal of Botany 5 (2): 144-152, 2009;* ***doi:*** *10.3923/ijb.2009.144.152)*

## Variation of Some Nutritional Constituents and Fatty Acid Profiles of *Chlorella vulgaris* Beijerinck Grown under Auto and Heterotrophic Conditions

Mostafa M. El-Sheekh and Alaa A. Fathy

This study is an attempt to evaluate the nutritional value of *Chlorella vulgaris* Beijerinck grown under autotrophic and heterotrophic conditions concerning their content of carotenoids, protein, proline, total free amino acids and fatty acids. Chlorophyll a (Chl.a) content of autotrophic cells of *C. vulgaris* was double that estimated in heterotrophic cells, while chlorophyll b (Chl.b) content of autotrophic cells was nearly half the value recorded for heterotrophic cells. Carotenoids (Car.) content of heterotrophic cultures decreased by 30.82% compared to that value of autotrophic cells. There was a slight decrease in the protein content of *C. vulgaris* under heterotrophic conditions. When the composition of total free amino acids and proline of *C. vulgaris* grown under autotrophic conditions is compared to that grown heterotrophically, it was observed that a significant increase in total free amino acids and proline in heterotrophic cultures. The percentage of most fatty acids of heterotrophic cells was relatively higher than autotrophic ones. There was no qualitative difference between autotrophic and heterotrophic cultures, except for the fatty

acid 16:02 which was absent under autotrophic conditions. Present results showed that *C. vulgaris* has quite a simple qualitative fatty acids composition compared to other chlorophycean species, considering production of natural food supplements and/or natural pharmaceutical products, it is strongly recommended using autotrophic cells of *Chlorella* rather than using those of heterotrophic cells for such purpose. *(International Journal of Botany 5 (2): 153-159, 2009; **doi**: 10.3923/ijb.2009.153.159)*

## Identification of Peach Genotypes (*Prunus persica* (L.) Batsch) in the North-Central Region, Mexico

C.M. Melgoza Villagómez, H. Silos Espino, A. Nava Cedillo, L.L. Valera Montero, C. Perales Segovia, C.A. Martínez Guerra, G. Martínez Guerra, A. Cruz Hernández and O. Paredes López

Twenty four peach genotypes from the Central North Region of Mexico, were characterized based on morpho-physiological traits. Fruit weights from the genotypes Roxana (135 g), San Gabriel C-167 (141.9 g) and Zacatecas landrace (162.3 g) were the higher, each in its group, since all genotypes were grouped according to their readiness to harvest as early-, middle- and late-harvest, respectively. RAPDs analysis yielded 52 monomorphic and 93 polymorphic fragments that were related to desirable characteristics from the *Prunus* genotypes. This information provide us tools for early individual identification of high-performance trees when still growing in the nursery. Therefore, growers may use this technique for assisted breeding program on their *Prunus* genotypes. *(International Journal of Botany 5 (2): 160-165, 2009; **doi**: 10.3923/ijb.2009.160.165)*

## Development of Elephant Apple Fruit Quality as Affected by Postharvest Ethanol Application and Temperature

A.B.M. Sharif Hossain, A. Nasrulhaq Boyce and Haji Mohamed

Experiments were conducted to study the effects of temperature and ethanol application on the development and quality of the elephant apple fruit. Various treatments were carried out, viz., at room temperature (RT, 28°C), in exposed sunlight (ES, 35°C), in 70% ethanol (ET, 28°C), under plastic covering (PC, 28°C), under plastic covering plus 70% ethanol (PCET, 28°C), at low temperatures (LT, 12°C) and at freezing temperature (FT, -1°C). The longest preservation time was observed in fruits preserved in FT (-1°C) and shortest in

fruits preserved in ES (35°C) whilst the maturity index was highest in ES (35°C) treatments and lowest in FT (-1°C) compared to the other treatments at the end of the experiments. However, fruits kept at FT (-1°C) exhibited chilling injury symptoms. Total Soluble Solids (TSS) was highest in ES (35°C) and PCET (28°C) from the 1st to the 7th harvest compared to other treatments. A similar increasing trend in TSS was observed in all the treatments. On the contrary, Titratable Acidity (TA) was highest in FT (-1°C) and LT (12°C) from the 1st till the 7th harvest. Similarly a declining trend of TA was found in all the other treatments. TSS was found to be higher in pulp than in peel in the ethanol treatment at 6, 12, 24, 48 and 72 h. However, TA was higher in peel than pulp. The results showed that low temperatures (LT and FT) and plastic covering with 70% ethanol (PCET) delayed ripening in elephant apple fruits and were the best preservation techniques. *(International Journal of Botany 5 (2): 166-170, 2009; **doi:** 10.3923/ijb.2009.166.170)*

## Pharmacognostical Comparison of Three Species of *Himatanthus*

José Luiz Pinto Ferreira, Ana Cláudia Fernandes Amaral, Renata Bastos de Araújo, Júnior Ribeiro Carvalho, Carolyn Elinore Barnes Proença, Sandra Aparecida Padilha Magalhães Fraga and Jefferson Rocha de Andrade Silva

The species *Himatanthus sucuuba* (Spruce ex Müll. Arg.) Woodson shows a wide range of use in folk medicine and other Amazonian species of this genus: *H. bracteatus* (A.DC.) Woodson and *H. stenophyllus* Plumel are also used by the great similarity between them. This study describes the macroscopic and microscopic morphological variation of leaves and stem bark of these species collected in the Amazonas state (Brazil). The contour of the leaf lamina, apex and the petiole aspects and the venation pattern were important features. The barks of *H. bracteatus*, differently from the other two species, did not present prismatic calcium oxalate crystals. Additionally, the extracts of the leaves, barks and latex of these species and the iridoids, plumieride (major in aqueous extracts of the leaves and latex from *H. bracteatus* and *H. sucuuba*) and isoplumieride (minor in all samples), were analyzed by HPTLC. The chromatographic profiles and the morphological analyses provided data for differentiation among the species. *(International Journal of Botany 5 (2): 171-175, 2009; **doi:** 10.3923/ijb.2009.171.175)*

## A Preliminary Study on the Antibacterial Activity of *Quercus brantii* Against Bacterial Pathogens, Particularly Enteric Pathogens

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

The antibacterial activity of *Q. brantii* fruits 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*, *Pseudomonas aeruginosa*). These extracts had inhibitory effect at various concentrations (0.5, 0.1, 0.2, 0.3 and 0.4 g $mL^{-1}$) against tested bacteria. The ethanolic extract had the highest activity (30 mm) against *Br. melitensis* and *B. bronchiseptica* while the lowest activity (7 mm) was demonstrated by the methanolic extract on *E. coli*. Studies on the Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) of the methanolic extract on tested microorganisms showed that the highest MIC (20 mg $mL^{-1}$) and MBC (32 mg $mL^{-1}$) were demonstrated against *Sh. dysenteriae*, *B. bronchiseptica* and *P. mirabilis* had the highest MIC and MBC values (32 mg $mL^{-1}$) for the ethanolic extract. *(International Journal of Botany 5 (2): 176-180, 2009;* ***doi****: 10.3923/ijb.2009.176.180)*

## The Effect of Stratification on Seed Germination of *Jasminus fruticans* L. (Oleaceae): A Contribution to a Better Insight on the Species Germination Ecology

E. Pipinis, E. Milios, M. Aslanidou, O. Mavrokordopoulou and P. Smiris

A germination experiment was carried out in the laboratory to evaluate the effect of stratification on seed germination of *Jasminus fruticans*. Nine different treatments were used to break the embryo imposed dormancy. Seeds were subjected to warm stratification (20/25°C) for 1 or 2 months, cold stratification (2-4°C) for 1, 2 or 3 months and to the following warm plus cold stratification combinations: 1 month warm plus 1 month cold stratification (1W+1C), 1 month warm plus 2 months cold stratification (1W+2C), 2 months warm plus 1 month cold stratification (2W+1C) or 2 months warm plus 2 months cold stratification (2W+2C). Maximum germination (86.00%) and minimum mean germination time (11.26 days) were attained after 3 months of cold stratification without warm

stratification. Seeds that were subjected to 2 months cold stratification exhibited 70.50% germination, whereas those stratified for 1W+2C or 2W+2C exhibited 69.00 or 67.50%, respectively. One month of cold stratification resulted in a germination percentage equal to 21%, whereas seeds that were subjected to warm stratification for 1 or 2 months prior to 1 month cold stratification gave germination percentages equal to 18.50 and 20.00%, respectively. None of the control seeds or those that were warm stratified for 1 or 2 months germinated. Results revealed that several months of cold stratification (3 months) were required to overcome physiological dormancy and to enhance *Jasminus fruticans* seed germination. *(International Journal of Botany 5 (2): 181-185, 2009; **doi:** 10.3923/ijb.2009.181.185)*

## Management of Iron Deficiency Stress in Citrus through Soil Application of Vivianite to a Calcareous Soil

Tarek G. Ammari, Alaeddin B. Tahboub and Taleb R. Abu-Zahra

Iron deficiency is a common abiotic stress in citrus trees grown on calcareous soils, where considerable reduction in yield is expected if not treated. In this study the effectiveness of synthetic vivianite [$(Fe_3(PO_4)_2.8H_2O)$] to prevent Fe chlorosis in citrumelo Swingle (*Citrus paradisi* Macf. x *Poncirus trifoliata*) a susceptible rootstock to Fe deficiency stress, was investigated. One-year old citrumelo plants were grown on calcareous soil-sand mixture under greenhouse conditions and treated with: (1) no Fe (as control); (2) 1.6 g FeEDDHA plant$^{-1}$ (3) 5.4 g vivianite plant$^{-1}$. Chlorophyll measurements were performed on the youngest fully expanded leaves in terms of SPAD index and at the end of the experiment leaf chlorophyll and Fe concentrations and growth vigor (young shoot dry weight) were determined. Vivianite was as effective as the FeEDDHA. Vivianite significantly prevented the development of Fe chlorosis. Chlorophyll concentration of plants treated with vivianite was significantly higher than those of control plants although vivianite-treated plants had almost equal leaf Fe concentration as control plants, vivianite significantly improved the vigor of citrus plants similar to the FeEDDHA compared to the control treatment. These results suggest that vivianite is an effective alternative to the environmental-unfriendly and expensive Fe-chelates for preventing Fe deficiency in citrus orchards. *(International Journal of Botany 5 (2): 186-189, 2009; **doi:** 10.3923/ijb.2009.186.189)*

## Effect of Waste Water on Heavy Metal Accumulation in Hamedan Province Vegetables

M. Cheraghi, B. Lorestani and N. Yousefi

The objective of this research was to elucidate the effect of waste water on heavy metal concentration in vegetables. To this purpose a region fertilized with waste water (Najafi Boolvar, Hamedan, Iran) was chosen as a polluted area and a region without any waste water pollution (Heydareh, Hamedan, Iran) as a control area. Eight kinds of vegetables were collected from both areas, separately and after preparing, Pb, Zn, Cu and Mn concentrations of them, were measured by using the atomic absorption spectrophotometer. Present results showed that concentration of some heavy metals in vegetables grown in Najafi Boolvar was several times as high as that in Heydareh. According to the results of present study, waste water have special problems for vegetables and thus for human health, because of ability of accumulating heavy metals in soil and biological accumulation of these elements in food chain. *(International Journal of Botany 5 (2): 190-193, 2009;* ***doi:*** *10.3923/ijb.2009.190.193)*

## A Floristic List and Phenology of Plant Species of Lawat Area District Neelum, Azad Jammu and Kashmir, Pakistan

M.E.U.I. Dar and Z.H. Malik

The objective of this study was to collect the detailed information of plant biodiversity and phenological pattern of plant species in the area. For this purpose, detailed surveys were done during the months of March to November in 2005 and 2006. One hundred and eighty plant species were recorded from Lawat hills belonging to 66 families and 144 genera. The families Asteraceae, Balsaminaceae, Gentianaceae, Lamiaceae, Poaceae, Polygonaceae, Primulaceae, Ranunculaceae, Rosaceae, Scrophulariaceae and Umbellifereae were recorded with major contribution to the flora of the investigated area. Fifty one plant species (29%) flowered from March to May, 83 plant species (45%) flowered from the month of June and July, while 46 plant species (26%) flowered from August to September. Eleven plant species in the investigated area were reported as evergreen. *(International Journal of Botany 5 (2): 194-199, 2009;* ***doi:*** *10.3923/ijb.2009.194.199)*

## Epigeal Cryptocotyly in *Madhuca indica* J. F. Gmel. (Sapotaceae)

A. Mundhra and N.D. Paria

An unusual case of epigeal cryptocotyly found in *Madhuca indica* J. F. Gmel. (Syn. *Bassia latifolia* Roxb.) of Sapotaceae is described and discussed in this study. The morphological characters shown by *M. indica* seedlings such as thickened hypocotyl, thick woody seed coat and non photosynthetic haustorial cotyledons are closely related to its epigeal cryptocotyly. The incidence of epigeal cryptocotylar germination in angiosperms seems to be scarce in available literatures. Such knowledge of germination and seedling morphology can throw some light in the silvicultural practices of this tree. *(International Journal of Botany 5 (2): 200-202, 2009; **doi:** 10.3923/ijb.2009.200.202)*

## A Late Tertiary Pollen Record from Niger Delta, Nigeria

O.E. Ige

This study presents the results of palynological investigations carried out on Atala-1 well, Niger Delta, Nigeria. The samples yielded pollen and spores and the identification of the pollen and spores, their relative diversity and abundance provide data on which the palaeoenvironmental interpretations were based. Nine informal lithological units were delineated for the well, characterized by silty clay and very fine to very coarse sand grains which are typical of Benin and Agbada formations of the Niger Delta. Four pollen zones (PZ I-IV) were recognized from the pollen diagram and attempt was made at the reconstruction of the vegetation for the zones. The early part of the zone (I) was characterized by unstable wet and dry climatic conditions characterized by contrasting fluctuations between the percentage occurrence of *Rhizophora* sp. and Poaceae. The vegetation was gradually dominated by mangrove swamp vegetation towards the later part of the zones (II-IV), indicating a wet and moist climates for the period and a rise in sea level. *(International Journal of Botany 5 (3): 203-215, 2009; **doi:** 10.3923/ijb.2009.203.215)*

## The Bryophyte Flora in the Urban Area of Aydin (Turkey)

M. Kirmaci and E. Ağcagil

In this study, the bryophyte diversity and urban bryophyte flora of the city of Aydin was investigated. Research area was divided into three zones and nearly

500 bryophyte specimens were collected in 13 representative stands. One hundred and twenty three moss species belong to 22 families and 78 genera, 22 liverwort species belong to 14 families and 19 genera and one hornwort species were found in the area. *Fossombronia echinata* and *Crossidium crassinerve* which were recently recorded from Turkey were collected from the area as a second distributional locality. *Tortula muralis*, *Didymodon vinealis*, *Grimmia pulvinata*, *Bryum argenteum* and *Orthotrichum diaphanum* are the most common species found in the city center where high pollution exists. The protected areas in the city centre such as gardens, cemeteries, school yards etc. are necessary in order to protect of bryophytes. These areas are important to provide various habitats to small organism like bryophytes. *(International Journal of Botany 5 (3): 216-225, 2009;* ***doi:*** *10.3923/ijb.2009.216.225)*

## The Bryophyte Flora of Honaz Mountain (Denizli/Turkey)

Mesut Kirmaci and Adnan Erdağ

The bryophyte flora of Honaz Mountain of Aegean Region (Western Turkey) has been investigated. One hundred and seventy five moss species belonging to 24 families and 64 genera, 20 liverwort species belonging to 14 families and 16 genera and one hornwort species were found on the area. *Orthotrichum rivulare* Turner and *Weissia breutelii* Müll. Hal. which was recently recorded from Turkey are collected from the area as a second distributional locality. And also some interesting taxa which are *Didymodon validus*, *Orthotrichum cupulatum* var. *bistratosum* and *Phascum cuspidatum* var. *schreberianum* collected from study area and discussed in the text. *(International Journal of Botany 5 (3): 226-235, 2009;* ***doi:*** *10.3923/ijb.2009.226.235)*

## Evaluation of Mychorrhizae Symbiosis Efficiency with Barley (*Hordeum vulgare* L.) through $^{32}P$ Uptake under Soils Contaminated with Heavy Metals

M.R. Ardakani, S. Teimuri, M. Rezvani, H. Fathollahi, A. Khorasani, F. Rejali, A. Raza and F. Zafarian

This study designed to investigate more precise of mycorrhizal symbiosis in order to increasing mineral absorption by plant root system. Three pot experiments, radioactive with $^{32}P$, non-radioactive and a trial with selected strain (from first and

second trials) with heavy metals (Cd, Co and Pb) contaminated soil were set up for evaluation the efficacy of four mycorrhizae strains including *Glomus mosseae*, *G. etanicatum, G. intraradices*, mixed strains (combination of *G. mosseae, Gigarpora hartiga* and *G. fasciculatum*) in order to investigate the uptake, translocation and distribution of $^{32}P$, P and also dry matter in barely in a glass house. Radioactive phosphorus ($^{32}P$) was used in this study. Results revealed that *G. mosseae* had the highest amount of P uptake in comparison with other strains. It indicates that differences exist among mycorrhizae strains towards $^{32}P$ uptake and its transportation to shoot. Increased strain count of *G. mosseae* was found in contaminated pots in trial with contaminated soil along with higher P concentration in root and shoot than non-inoculated plant roots. *(International Journal of Botany 5 (3): 236-243, 2009;* ***doi:*** *10.3923/ijb.2009.236.243)*

## *In vitro* Growth of Wheat (*Triticum aestivum* L.) Seedlings, Inoculated with *Azospirillum* sp., Under Drought Stress

M.H. Arzanesh, H.A. Alikhani, K. Khavazi, H.A. Rahimian and M. Miransari

This research was conducted to determine: (1) the effects of drought on wheat seedlings growth under *in vitro* and dark conditions and (2) if inoculation of wheat seedlings with *Azospirillum* sp. can alleviate the unfavorable effects of drought on the growth of wheat seedlings. *In vitro* planted seedlings were subjected to different drought intensities using poly ethylene glycol and were inoculated with 25 *Azospirillum* strains including the isolated ones and the standard strains of *A. halopreaferanse*, *A. brasilense*, *A. irakense* and *A. lipoferum*. Different strains of *Azospirillum* sp. enhanced seedlings growth and adjusted their water behavior under drought. Such results in combination with the previously related results indicate that *Azospirillum* sp. are able to enhance plant growth and production under different physiological and ecological conditions. *(International Journal of Botany 5 (3): 244-249, 2009;* ***doi:*** *10.3923/ijb.2009.244.249)*

## Rapid Isolation of Genome DNA Suitable for PCR from Tropical Almond (*T. catappa)* Plant Populations

B.O. Oboh, L.A. Ogunkanmi and N. Agwu

This study was conducted to develop a rapid and efficient method for the isolation of genomic DNA from the tropical woody tree, *Terminalia catappa* L. Fresh young leaves from 35 trees were sampled for the extraction of genomic DNA. The

methodology employed excluded the use of liquid nitrogen and an ultracentrifuge with various modifications in the quantities and reagents used. The result of the extraction showed that genomic DNA of good quality and quantity with a spectrophotometric ratio of between 1.7-2.0 for the trees sampled. Result further showed that the extracted DNA on 1% agarose gel had high molecular weight bands following electrophoresis. Thus, we concluded that the modified protocol used for the extraction of genomic DNA in *T. catappa* which can be easily adapted to other crops produced DNA of good quality and quantity which can be used for PCR based studies. *(International Journal of Botany 5 (3): 250-254, 2009;* ***doi:*** *10.3923/ijb.2009.250.254)*

## Evolutionary History of the Genus *Pistacia* (Anacardiaceae)

M.G. Al-Saghir

*Pistacia* L. belongs to the family Anacardiaceae (cashew family), order Sapindales. *Pistacia vera* L. (cultivated pistachio) is by far the most economically important species in the genus. It has edible seeds and considerable commercial importance. The evolutionary history and the phylogenetic relationships between species within the genus are not well understood. A better understanding of these relationships is needed to make the species more useful for plant improvement or genetic studies. The objective of this perpestective is to provide additional insight into understanding the evolutionary history of *Pistacia*. In conclusion, *Pistacia* is a monophyletic genus and it contains two sections (*Lentiscella* and *Pistacia*) and it is originated in the Paleocene epoch. This is based on Anacardiaceae being pantropical in distribution with North and South America representing major diversification centers of the family including the geographical distribution of Pistacia. This perspective provides additional insight into understanding the evolutionary history of the genus *Pistacia* to make the species more useful for plant improvement or genetic studies. *(International Journal of Botany 5 (3): 255-257, 2009;* ***doi:*** *10.3923/ijb.2009.255.257)*

## First Record of *Cheimonophyllum* Singer from Turkey

A. Kaya

This study deals with the first record of pleurotoid fungus *Cheimonophyllum candidissimum* (Berk. and M.A. Curtis) Singer (*Cyphellaceae*) growing on *Alnus* sp. wood from Kahramanmaraş, Turkey. *(International Journal of Botany 5 (3): 258-260, 2009;* ***doi:*** *10.3923/ijb.2009.258.260)*

## Phytosociological Attributes of Wadi Gaza Area, Gaza Strip, Palestine

M.M. Abou Auda, K.F. El-Sahhar and N.Y. Deeb

Wadi Gaza area, Gaza Strip, Palestine was subjected to a phytosociological study through 24 trips in the period from March to September 2007. This area has a characteristic semi-arid climate and locates in a transitional zone between Mediterranean, Negev and Sinai regions. Nine quadrats (10×10 m) at buttom, bank and open field wadi in six locations; namely, Al-Brikat, Al-Nabaheen, Al-Saoud, Al-Bahr, Al-Rabowa and Abu-Malaa representing the entire area of Wadi Gaza, Gaza Strip were chosen to study the vegetation, including species cover-abundance, species frequency, relative frequency, community similarity, in addition to soil analysis. Some quadrats were pure stand of one species; e.g., *Tamarix nilotica* in Al-Rabowa and *Arundo donax* in Abu-Malaa. Some species like *Cynodon dactylon* were restricted only to one place (wadi bank) of the location (Al-Brikat) due to the lower degree of animal grazing and the moisture availability. *Alhagi graecorum* and *Silybum marianum* recorded the highest species frequency in the studied area. Unique occurrence of some salinity tolerant species were observed in Al-Bahr (a coastal location). The highest similarity was found between Al-Brikat wadi bank and Al-Nabaheen wadi open field. In contrast to the dissimilarity between both of Abu-Malaa and Al-Rabowa wadi buttom and other locations as they were pure stands and more or less unique locations. Physical and chemical structure of soil varied according to soil texture, pH values, salinity, moisture, sewage water, urban effect and bordering agricultural fields. *(International Journal of Botany 5 (4): 261-269, 2009;* ***doi:*** *10.3923/ijb.2009.261.269)*

## Pollen Grains of Lagos Lagoon Swamp and Hinterland Vegetation-I

O.H. Adekanmbi and O.T. Ogundipe

In order to aid pollen identification, which is the bedrock of palynological studies, 14 plant species belonging to 4 families were subjected to standard palynological sample preparation. Taxa in the collection belong to the families Acanthaceae, Amaranthaceae, Apocynaceae and Aracaceae. Pollen grains belonging to the family Acanthaceae are mostly prolate in equatorial view and trigonal to circular

in polar view. Family Amaranthaceae pollens are eurypalynous comprising of different morphological types of pollen, ranging from inaperturate to polyporate. Genera in the family Apocynaceae exhibit palynological extremes indicated by variety in the shape of the pollen grains, aperture, size and ornamentation of the studied species. Pollen grains in Aracaceae also exhibit variations ranging from monocolpate to trichotomosulcate nature of aperture. Light micrographs, detailed descriptions of the species and where possible Scanning Electron Micrographs are provided. It is established from this study that identification of palynomorphs should not pose a problem to the application of palynology even in fields other than biostratigraphy such as forensic studies, mellisopalynology, and medicine (e.g., alleviation of pollinosis). *(International Journal of Botany 5 (4): 270-278, 2009; **doi:** 10.3923/ijb.2009.270.278)*

## Xylem Conductivity and Anatomical Traits in Diverse Lianas and Small Tree Species from a Tropical Forest of Southwest Mexico

Mario Gutiérrez, Rubén San Miguel-Chávez and Teresa Terrazas

Seven lianas and four small trees collected from a tropical rainforest of Southwest Mexico were studied to relate vessel diameter and vessel frequency to the relative hydraulic conductivity (RC), vulnerability to cavitation and anatomical traits on the secondary xylem. The seven liana species and four small tree species represented ten different families. Two liana species (*Passiflora ligularis* A. Juss. and *Vitis tiliifolia* Humb. and Bonpl.) showed the highest vessel diameters, RC and vulnerability to cavitation. A small tree (*Petrea volubilis* L.) presented the lowest values for vessel diameter, RC and cavitation. Narrow vessels determined the vessel frequency per $mm^2$ (-0.58) while wider vessels showed low influence (-0.24). Wider and narrow vessels determined RC and vulnerability to cavitation ($r = 0.59$ to 0.76). Generally, wider vessels presented solitary distribution on the secondary xylem in liana and small tree species and narrow vessels were grouped in clusters. Liana species presented parenchyma in diverse forms, while parenchyma was scanty in the small tree species. The eleven species showed a broad range in RC and vulnerability to cavitation and showed diversity in anatomical traits on secondary xylem indicating that they have different anatomical adaptations with similar growth habit. *(International Journal of Botany 5 (4): 279-286, 2009; **doi:** 10.3923/ijb.2009.279.286)*

## Effect of Topography and Soil on the Distribution of under Canopy Trees of *Garcinia* (Guttiferae) in Lowland Forest of Peninsular Malaysia

M. Nazre, A. Latiff and M.K. Mohamad-Roslan

The distribution and aggregation of species in tropical forests is known to have certain preferences based on the edaphic factors such as topography types and soil series and this study was carried out to see the distribution of 16 *Garcinia* species in lowland dipterocarp forest in Pasoh Forest Reserve with those edaphic factors. Even though there have been many studies in large scale areas with a larger group of species to see the relationship of edaphic factors with species distribution, very few studies have been carried out on individual species especially for under-canopy or lesser known species. *Garcinia* is an under-canopy tree species in tropical South East Asian forests with no commercial values but mostly known because of their edible fruits. Based on published topography and soil series maps in 50 ha plot, the preferences of *Garcinia* trees were analysed and calculated. Results showed that *Garcinia* trees could be found on all types of topography and soil but most trees are distributed very well on the flatland and well-drained alluvium soils rather than other areas. The least number of stems found are in the top (highest) topography and poorly-drained (prone to flood) alluvium soil. However, at species level, there are significant preferences of each *Garcinia* species on the different type of topography and soil. This shows that different type of topography and soil play significant effect on the distribution of *Garcinia* trees in tropical lowland forest. *(International Journal of Botany 5 (4): 287-294, 2009;* ***doi:*** *10.3923/ijb.2009.287.294)*

## Pollen Grains of Asteraceae and Analogous Echinate Grains

O.H. Adekanmbi

Seven plant species belonging to 3 families were subjected to standard palynological sample preparation in other to provide additional tool in pollen identification. Taxa in this study include the families Asteraceae, Convolvulaceae and Malvaceae. Pollen grains belonging to the family Asteraceae are unique in being characteristically echinate. They can be differentiated from similar pollen in other families by the relatively small size of both the pollen and the spines and the irregular arrangement of the spines. Pollen of *Ipomoea aquatica* belonging to the family Convolvulaceae has spines like found in Asteraceae but can be distinguished in that those of Convolvulaceae are remarkedly bigger in size. *Hibiscus rosasinensis* a species in the family Malvaceae share the same echinate

characteristics but peculiar in possessing isolated spines, which stand out conspicuously. The pollen grain is differentiated from Convolvulaceae pollen in being larger. Light micrographs, detailed descriptions of the species and where possible Scanning Electron Micrographs are provided. This study is expected to be useful in palaeoecology research, petroleum exploration, honey industry and in forensic investigations. *(International Journal of Botany 5 (4): 295-300, 2009; **doi**: 10.3923/ijb.2009.295.300)*

## Macromycetes of Genç District (Bingöl-Turkey)

Y. Uzun, A. Kaya, A. Keleş, M.E. Akçay and İ. Acar

The study was conducted on the macrofungi specimens collected from Genç district (Bingöl-Turkey) between 2006-2009 to determine the macromycota of the region. Seventy eight taxa belonging to 23 families in *Ascomycetes* and *Basidiomycetes* classes were identified. Agaricaceae, Tricholomataceae and Strophariaceae are the most crowded families in the region. All of the taxa are new for the district. *Omphalotus olivascens* var. *olivascens* (*Marasmiaceae*) is determined as new record for Turkish macromycota. *(International Journal of Botany 5 (4): 301-306, 2009; **doi**: 10.3923/ijb.2009.301.306)*

## *Wolffia columbiana* Can Switch Between Two Anatomically and Physiologically Separate States: Buoyant for Invasion and Starch Rich for Colonization

Michael Witty

Turion formation is poorly studied in all of the *Wolffi*a species and only narrow studies have been done. In this study details of *Wolffia columbiana* ecology and physiology are related to anatomy and histochemistry. We used a combination of histochemistry and a new method of pressing tissue into one focal plane to reveal anatomical features that are not visible using conventional methods. Previously unknown organs, wax coated substomatal cavities, are described which play a crucial role in *Wolffia* ecology. Tank experiments were used to determine the behavior of *Wolffia columbiana* plants in response to light and dark conditions. A physiological mechanism for transition between an invasive floating population and dormant benthic population using oxygen floatation is described, which involves *Wolffia columbiana* behaving like a small bathyscaphe. This mechanism is combined with accumulation of large stores of starch and is an adaptation to colonization and overwintering. *(International Journal of Botany 5 (4): 307-313, 2009; **doi**: 10.3923/ijb.2009.307.313)*

## Characteristics of Cogon Grass Rhizomes and its Perforation of a Maiden Cane Rhizome

J.J. Muchovej, O.U. Onokpise and S.K. Bambo

Cogon grass (*Imperata cylindrica*) is one of the most aggressive grasses world wide and spreads by an extensive rhizome system. This study adds observational detail to growth of cogon grass rhizomes and provides for a mechanism by which cogon grass is able to perforate other species of plants. During a competition study between *I. cylindrica* and native grasses, where the plants were grown in 30 cm pots, under greenhouse conditions, the underground systems were harvested by removing the root ball from the pot, then removing the potting mixture in order to un-potted for determination of length and weight of rhizomes and roots. In one pot, a unique situation was observed where a rhizome of cogon grass had perforated and traversed a rhizome of maiden cane. Aside from the physical damage, the rhizome of the maiden cane did not appear to be diseased. This study describes the rhizomes of the two plants and documents penetration. While cogon grass can penetrate other below ground parts of other species of plants, it does not appear to provide for major damage. *(International Journal of Botany 5 (4): 314-316, 2009; **doi:** 10.3923/ijb.2009.314.316)*

## Comparative Studies on Aluminum Tolerance Screening Techniques for Sorghum, Soybean and Maize in Simple Solution Culture

A. Akhter, T. Wagatsuma, M.S.H. Khan and K. Tawaraya

Toxic symptoms of crop plant species to Al are widely studied. The most dramatic symptom of Al toxicity is the inhibition of root elongation. As a matter, this symptom long been used to know the Al-tolerance of plant species. But, there was some scope to search proper concentration of Al during the study of Al-tolerance screening. Objective of the present study was to recommend proper concentration of Al for maize (Al-tolerant), soybean (intermediate Al-tolerant) and sorghum (Al-sensitive). Two concentrations of Al (2.5 and 2 0 μM $AlCl_3$ in 0.2 mM $CaCl_2$) were used. For maize former concentration (2.5 μM) was too light to inhibit root elongation (Al tolerance 60-77%) and could not discriminate Al-tolerance among the cultivar whereas later concentration 20 μM represents better illustration of tolerances (40-65%). Soybean was intermediate Al-tolerant crop and both concentration of Al could be suggested for Al-tolerance screening of this crop (40 to 79% for low Al and 17 to 65% for high Al). Sorghum was Al sensitive and high Al concentration made so severe inhibition of root elongation to

all cultivars that Al-tolerance among the cultivars could not be differentiate well (Al tolerance 20-24%). On the other hand, at low Al concentration Al-tolerance was in the range of 38-51%. All crop species showed significant positive correlation ($R^2 = 0.945^*$, $0.936^{**}$ or $0.921^{**}$ for sorghum, soybean and maize, respectively) between the Al tolerance from 2.5 and from 20 μM Al. From these results it could be suggested that treatment concentration for Al tolerance screening should be conducted based on the Al tolerance level of each crop species. *(American Journal of Plant Physiology 4 (1): 1-8, 2009; **doi:** 10.3923/ajppaj.2009.1.8)*

## Carbohydrate Compositions and Peroxidase Activity in Ungerminated, Cotyledon and Embryo Tissues of *Vigna unguiculata* L. Walp Seed Grown Under Stress Temperatures

Shahidul Islam, R. Carvajal R. Carmen and Jr. James O. Garner

Twenty five cultivars were screened for germination at low (10°C), moderate (30°C) and at stress (40°C) temperatures. Three cultivars were chosen such as Texas Cream 40 was able to germinate at very high and low temperatures. Black Crowder demonstrated acceptable germination at high temperatures but negatively affected at low temperature. The main sugars present in cowpea seed were sucrose, raffinose and stachyose. Sugar contents were affected by cultivar, type of tissue and temperature. Sucrose contents were higher in embryo tissue of cultivars with low percent germination and reduced in the cultivar with higher percent germination suggesting the use of sucrose for germination. Sucrose decreased greatly at 30°C and increased again at 40°C. Raffinose and stachyose contents were higher in ungerminated seed. In germinated seed, raffinose and stachyose contents were found only in cotyledon tissues at 10°C. Peroxidase activities was affected by cultivars, type of tissue and temperature. The highest peroxidase activity was found at low temperature (10°C) in embryo tissue of the cultivar with the highest germination. High peroxidase activity was related to ability of seed to germinate at low temperature. *(American Journal of Plant Physiology 4 (1): 9-17, 2009; **doi:** 10.3923/ajppaj.2009.9.17)*

## Study on the Diurnal Changes of Net Photosynthetic Rate and the Impact Factors of *Stevia rebaudiana* Bertoni in Autumn

Lv Chengguo, Ma Lei and Shi Yan

Relationship between diurnal changes of net photosynthetic rate (Pn) and the impact factors in leaves of *Stevia rebaudiana* Bertoni were studied. Diurnal

changes of Pn and environmental factors (photosynthetic available radiation and temperature and relative humidity) and physiology factors (stomatal conductance and transpiration rate and intercellular $CO_2$) in leaves of *Stevia rebaudiana* Bertoni chicory were measured using LI-6400 portable photosynthesis system. The relationship between Pn and environmental factors were analyzed by regression analysis and path analysis. The results showed that the curve of diurnal changes of Pn was demonstrated two peaks in clear day and appeared midday depression at noon and the stomatal conductance decreased. All those were due to high photorespiration which was caused by high light intensity and high temperature. *(American Journal of Plant Physiology 4 (1): 18-23, 2009; **doi:** 10.3923/ajppaj.2009.18.23)*

## Functional Analysis of the *Elaeis oleifera* Sesquiterpene Synthase Promoter Reveals Non-Specific Tissue Expression and Activation under Stress Condition

Ismanizan Ismail, Norazreen Abdul Rahman, Chan Kok Fei, Zamri Zainal, Nik Marzuki Sidik and Che Radziah Che Mohd Zain

This research aimed to evaluate the specificity of sesquiterpene synthase promoter (SesqPro) activity in the oil palm tissues and tomato hairy roots and to determine the functional region of the promoter. The effect of jasmonic acid (JA) on the promoter activation and gene expression was also analyzed. A series of 5' sequence deletions on the full-length SesqPro were generated and individually cloned into the pCAMBIA 1301 vector. Functional analysis was carried out on leaves, mesocarp slices and Immature Embryos (IE) of oil palm and tomato hairy roots that had been transformed with full-length SesqPro (PSPr-VF6). GUS expression was found in all the tissues and a higher activity was detected in IE and mesocarp slices. All the constructed derivatives of SesqPro were transformed into IE and mesocarp slices in order to determine the promoter regions which are responsible for gene expression. The reduction of GUS activity was found to be related to the removal of DNA sequences within the promoter region. The promoter was induced by the elicitor molecule JA, thus suggesting the presence of JA responsive elements within the promoter. Incubation with 100 μM of JA showed higher GUS activity in IE and mesocarp slices that had been transformed with PSPr-VF4 to PSPr-VF6. Nevertheless, the GUS activity was drastically reduced in IE and mesocarp slices containing the PSPr-VF3 promoter, suggesting that the presence of the G/A hybrid box located at -622 to -617 act as a specific element in response to elicitors. This study has shown that the action of SesqPro is non-specific and was influenced by JA induction. *(American Journal of Plant Physiology 4 (1): 24-37, 2009; **doi:** 10.3923/ajppaj.2009.24.37)*

## The Inductive Role of Vitamin C and its Mode of Application on Growth, Water Status, Antioxidant Enzyme Activities and Protein Patterns of *Vicia faba* L. cv. Hassawi Grown under Seawater Irrigation

Mohamed M. Azooz and Mohamed A. Al-Fredan

This research was carried out to study the inductive role of vit. C and its mode of application in mitigating the detrimental effects of irrigation with diluted (10, 20 and 30%) seawater on *Vicia faba* L. cv. Hassawi plants. The results showed that, seawater level at 10% exhibited insignificant changes, while the higher levels impaired growth by reducing seeds germination, dry weights of shoot and root, water status and chlorophyll contents. However, seawater irrigation enhanced carotenoids, antioxidant enzyme activities, MDA and ion leakage. The detrimental effects imposed by seawater were ameliorated by application of 100 ppm vit. C either by seed soaking or shoot spraying. Shoot spraying method gave the best effect. The inductive role of vit. C was associated with improvement of seed germination, growth, plant water status, carotenoids, endogenous ascorbic acid and antioxidant enzyme activities, which consequently led to reduction in ion leakage and MDA level. Moreover, vit. C alone or in combination with seawater increased the intensity of protein bands as well as synthesized additional new proteins with molecular weights of 382, 154, 132, 106 and 67 kDa. This may lead to an increase in the tolerance mechanisms of treated plants towards seawater salinity. *(American Journal of Plant Physiology 4 (1): 38-51, 2009;* ***doi:*** *10.3923/ajppaj.2009.38.51)*

## Evaluation of Potassium Humate Effects on Germination, Yield and Yield Components of HPS-II/67 Hybrid True Potato Seeds Under *in vitro* and *in vivo* Conditions

D. Hassanpanah and M. Khodadadi

This experiment was done for evaluation the effects of potassium humate on seed germination, yield and yield components and seed planting method to commercial used of F1 true potato seed. This research was conducted in Ardabil (Iran) during 2007 and 2008. HPS-II/67 hybrid seed 3500 were grown after treatment in seven different times by potassium humate (for 6, 12, 18 and 24 h till complete germination in potassium humate solution, till complete germination in water and without using the potassium humate and water as control). Potassium humate was

used 40 mL $kg^{-1}$ seed in 2 L of water. Then seeds were transferred to greenhouse and planted in peat mass bed (Biolan). During growth period were measured the traits such as start and seed germination percent and day number from planting till germination in laboratory and greenhouse. Seedlings transferred in 4-5 leaf stages to field. Experimental design was randomized complete blocks with three replications. After harvest, were measured the traits such as tuber number and weight per plant, tuber weight average per plant and tuber yield. Results showed that among different treatments of potassium humate there is significant difference for the tuber number and weight per plant, tuber weight average per plant and tuber yield. The maximum seed germination percent, tuber number and weight per plant, tuber weight average per plant and tuber yield produced in 6 and 12 h treatment by potassium humate. Direct planting of TPS in compare with the planting after seed germination in potassium humate and water caused to increase tuber yield. In this experiment, seed treatment by potassium humate for 6-12 h and seed direct planting in greenhouse percent without seed germination under *in vitro*, caused to increase seed germination percent and tuber yield. *(American Journal of Plant Physiology 4 (1): 52-57, 2009;* ***doi:*** *10.3923/ajppaj.2009.52.57)*

## Agrobotanical Attributes, Nitrogen-Fixation, Enzyme Activities and Nutraceuticals of Hyacinth Bean (*Lablab purpureus* L.): A Bio-Functional Medicinal Legume

M. Naeem, M. Masroor A. Khan and J.B. Morris

Hyacinth bean (*Lablab purpureus* L.) accessions of different origins received from USDA, ARS, Plant Genetic Resources Conservation Unit, Griffin, GA, USA were evaluated for agrobotanical attributes, enzyme activities, nutraceuticals and quality in calcium deficient soil of Aligarh, Western Uttar Pradesh, India. Fresh and dry weights per plant, leaf-area, number and dry weight of nodules per plant, net photosynthetic rate, stomatal conductance and transpiration rate, total chlorophyll and carotenoid content, activities of nitrate reductase and carbonic anhydrase, leaf - N, P, K and Ca contents and nodule-nitrogen and leghaemoglobin contents, respectively were analyzed at 60, 90 and 120 day after sowing. Photosynthesis was measured only at 90 DAS. Yield attributes including pod number per plant, seed number per pod, 100-seed weight and seed-yield per plant were recorded at harvest (150 DAS). Protein and carbohydrate content as well as tyrosinase activity in hyacinth bean seeds were also determined. Among the five accessions, EC-497619 ($A_4$) showed superior performance over the rest of the accessions. Accession $A_4$ showed the highest values for growth, yield, physiological,

biochemical and quality attributes in comparison to the other accessions. Net photosynthetic rate, stomatal conductance and transpiration rate were found maximum in the $A_4$ accession. Chlorophyll and carotenoid content were also reported higher in accession $A_4$. Accession $A_4$ showed higher nitrate reductase and carbonic anhydrase activities than the other accessions. Nodule-nitrogen and leghaemoglobin content ranged from 5.267-5.314% and 0.110-0.130 mM, respectively. Mineral profiles, viz., nitrogen, phosphorus, potassium and calcium content varied from 3.610-3.643, 0.338-0.356, 3.020-3.124 and 1.764-1.804%, respectively. Seed protein of all accessions varied from 24.70-25.06%. Carbohydrate content ranged from 50.83-53.16% across all accessions tested. Accession $A_4$ produced the highest tyrosinase activity in the seeds. *(American Journal of Plant Physiology 4 (2): 58-69, 2009;* ***doi:*** *10.3923/ajppaj.2009.58.69)*

## Expression of the *Capsicuum annum* (Chili) Defensin Gene in Transgenic Tomatoes Confers Enhanced Resistance to Fungal Pathogens

Z. Zainal, E. Marouf, I. Ismail and C.K. Fei

Plant defensins are a group of pathogenesis-related defense mechanism proteins. Transgenic tomato plants expressing the chili defensin gene under the control of a Cauliflower Mosaic Virus 35S (CaMV 35S) promoter were generated. The 5 kDa peptide, corresponding to the chili defensin protein was detected in the total protein fraction extracted from the transgenic plants. When compared to partially-purified peptide extracts from untransformed tomato plants, those from transgenic plant possessed the ability to reduce the growth of several fungi *in vitro*. $T_2$ transgenic plants were selected and tested for resistance against *Fusarium* sp. and *Phytophthora infestans*. The transgenic lines were more resistant to infection by these pathogens than the control plants. *(American Journal of Plant Physiology 4 (2): 70-79, 2009;* ***doi:*** *10.3923/ajppaj.2009.70.79)*

## Effect of Different Variation of $NH_4^+$ Compared to N ($NH_4^+$ + $NO_3^-$) Fertilization of Tomato (*Lycopersicum esculentum*) Cultivated in Inert Media on the Fecundity of the Aphids *Macrosiphum euphorbiae* (Homptera-Aphididae)

A. Latigui and A. Dellal

Changes of 0, 20 and 35% of $NH_4^+$ compared to N ($NH_4^+$+$NO_3^-$) nutrient solutions of *Lycopersicum esculentum* L. cultivated on inert media on the

multiplication of *Macrosiphum euphorbiae* (Aphididae Homomptera) were tested. The use of 0% $NH_4^+$ decreased 12% the fertility of aphids compared to 20% $NH_4^+$ and 17% compared to 35% $NH_4^+$. Reproduction of aphids on the leaves of flowering inflorescence increased 33% compared to that of the fruit setting inflorescence and 40% compared to that of the magnification inflorescence and 52% relative to the fixed level. The interruption of the fertilization of plant and its replacement by water for 4 days decreased 45% the fertility of aphids in the fourth inflorescence and 36% in the seventh inflorescence. *(American Journal of Plant Physiology 4 (2): 80-88, 2009;* ***doi:*** *10.3923/ajppaj.2009.80.88)*

## Sterol Biosynthesis Inhibition by Paclobutrazol Induces Greater Aluminum (Al) Sensitivity in Al-Tolerant Rice

M.S.H. Khan, T. Wagatsuma, A. Akhter and K. Tawaraya

Al tolerance is one of the main growth and yield limiting factor in world and mechanism for Al-tolerance or Al-sensitivity yet to be clarified. We previously reported Japonica rice (*Oryza sariva* L.) cultivar Rikuu-20 as Al-sensitive, whereas a closely related cultivar that is a descendant of Rikuu-20, Rikuu-132, was Al tolerant. The objective of the present study was to clarify the role of plasma membrane lipid layer for Al tolerance in rice. The previously stated two cultivars were compared to determine mechanisms underlying variations in Al tolerance. The sensitive cultivar Rikuu-20 showed increased permeability of the Plasma Membrane (PM) and greater Al uptake within 24 h of Al treatment. Lipid composition of the PM differed between these cultivars was considered to be the primary account for the difference in Al tolerance. The tolerant cultivar Rikuu-132 showed a less PM permeabilization and Al accumulation which was drastically decreased in presence of paclobutrazol, a sterol metabolism inhibitor which reduces $\Delta^5$-sterols and accumulates abnormal sterols by inhibiting obtusifoliol-14α-demethylase. The tolerant cultivar Rikuu-132 had lower phospholipids than that of sensitive cultivar Rikuu-20, suggesting that the PM of Rikuu-132 is less negatively charged and less permeabilized than that of Rikuu-20. We used inhibitor of $\Delta^5$-sterol synthesis to alter the ratio of phospholipids to $\Delta^5$-sterols in both cultivars. These inhibitors reduced Al tolerance in Rikuu-132 whereas Al tolerance of Rikuu-20 was unchanged suggesting that PM lipid composition greatly regulating Al tolerance in rice. *(American Journal of Plant Physiology 4 (3): 89-99, 2009;* ***doi:*** *10.3923/ajppaj.2009.89.99)*

## Annual Trends in Evapotranspiration from Major Vegetations of Thailand

P. Attarod, V. Bayramzadeh, A. Tajdini and M. Roohnia

Evapotranspiration (ET) is an essential factor to estimate crop water use. It is also one of the major elements in soil water storage and water resource in a region. This study was accomplished to compare the yearly trends of ET among three main vegetations in Thailand, a rain-fed paddy rice field, cassava plantation and teak plantation. Bowen Ratio Energy Balance (BREB) technique was applied in this study to measure the ET and heat flux between ground surface and atmosphere. Penman-Monteith (PM) equation, recommended by FAO, was used to calculate reference crop evapotranspiration ($ET_0$). Measurements were carried out during 1999-2003 in the both paddy rice field and teak plantation and during 2002-2003 in the cassava plantation. The results indicated that the amount of daytime ET during the rainy season in the paddy rice field and cassava plantation varied between 1 and 7 mm and in the teak plantation between 2 and 6 mm. The averages amounts of daytime ET in the rainy season were about 4 mm in all sites, although, the variations of ET were different. In the dry season, day time ET of the cassava plantation was around 2.7 mm, slightly lower than those of other sites. During the growing season, $ET/ET_0$ varied in the paddy rice field between 0.4 and 1.2 and in the cassava between 0.3 and 1.2. In the rainy season, $LE/R_n$ ratios of the cassava plantation and paddy rice field were around 70%, while $LE/R_n$ ratio in the teak plantation was found to be around 73%. Long-terms trends of ET and $ET/ET_0$ were observed in the main vegetations of Thailand characterized by tropical monsoon climate. Meteorological data were limited to only routine meteorological measurements in this region. *(American Journal of Plant Physiology 4 (3): 100-108, 2009; **doi:** 10.3923/ajppaj.2009.100.108)*

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

Wu Xiao-lan, Lan Xiu-jin, Wei Yu-ming, Pu zhi-en and Zheng You-liang

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

J. Yeboah, S.T. Lowor and F.M. Amoah

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)

A.N. Aher, S.C. Pal, S.K. Yadav, U.K. Patil and S. Bhattacharya

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

H. Sood and R.S. Chauhan

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. kuura* 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

K. Nadarajah and N.M. Kassim

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

Ren Guangxi, Liu Xiangyang and Shi Yan

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 radio 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)*

## Pre-Planting (Cold) Treatment of *Allium sativum* Cloves Improves its Growth and Yield Under Open Field and Open Shade Conditions

O.E. Ade-Ademilua, T.O. Iwaotan and T.C. Osaji

The effects of open field and open shade environmental conditions on the growth and yield of untreated and cold treated cloves of *A. sativum* were investigated. Plants from untreated cloves grew higher under open shade, while those from treated cloves grew higher in the open field. Leaf production was influenced under open field condition and not by pre-planting cold treatment of cloves. There was no significant difference in the total leaf area and fresh weight of plants from untreated cloves grown in the open field and those of treated cloves grown in the open shade until day 56 and 70, respectively. Pre-planting cold treatment of garlic cloves enhanced total leaf area, fresh and dry weight of plants under open shade. Plants from treated cloves had better yield (clove/bulb, clove size, clove dry weight and allicin content/clove) than plants from untreated cloves irrespective of the light condition. Results show that pre-planting treatment of garlic cloves did not only enhance dry matter production but also the allicin content of harvested cloves even under open shade conditions. Plants from treated cloves grown in the open field had the best growth while plants of untreated cloves grown under open shade had the worst (50% less than the former). However, plants from treated cloves grown under open shade had very close growth characteristics with plants from untreated cloves grown in the open field. Results show that the cold pretreatment of garlic cloves help to improve its yield and ability to utilize light. *(Journal of Plant Sciences 4 (3): 49-58, 2009;* ***doi:*** *10.3923/jps.2009.49.58)*

## Molecular Characterization of the *Waxy* Gene in Einkorn Wheat

Ya-Xi Liu, Wei Li, Yu-Ming Wei, Guo-Yue Chen and You-Liang Zheng

This study characterizes 15 *waxy* genes from 15 accessions of the einkorn wheats *Triticum urartu*, *T. boeoticum* and *T. monococcum*. The mature protein coding sequences of *waxy* genes were analyzed. Nucleotide sequence variations in these regions resulted from base substitution and/or indel mutations. This work identified 8 distinct haplotypes from the diploid wheat *waxy* gene sequences. A main haplotype was found in 7 gene samples from the $A^u$ genome and $A^m$ genome. The *waxy* gene sequences from the $A^u$ and $A^m$ genomes could be obviously clustered into two clades, but the sequences from the $A^m$ genome of *T. boeoticum* and

*T. monococcum* could not be clearly distinguished. The phylogenetic analysis revealed that the *waxy* gene sequences from the $A^m$ genome had accumulated fewer variations and evolved at a slower rate than the sequences from the $A^u$ genome. These results would contribute to the understanding of functional aspects and efficient utilization of *waxy* genes. *(Journal of Plant Sciences 4 (4): 114-121, 2009;* ***doi:*** *10.3923/jps.2009.114.121)*

## Study of Air Pollution Effects on Some Physiology and Morphology Factors of *Albizia lebbeck* in High Temperature Condition in *Khuzestan*

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

The main purpose of this study is to determine some physiological and morphological characters of *Albizia lebbek* grown in high temperature condition of Khuzestan in Iran. The location was selected because of high rate of industrial pollution that is caused by petrochemical companies. *Albizia lebbeck* Benth. is a deciduous tree with compound leaves, flat oblong fruits, round cream colored seeds, grows wild and planted in almost south of Iran. The plant is found throughout tropical and subtropical Asia and Africa. The concentrations of chlorophyll A, B total chlorophyll, carotenoid, soluble sugar, proline and morphological effects were examined in the leaves of tree species (*Albizia lebeck*), growing in polluted area in comparison with natural condition. In the polluted regions higher concentrations of soluble carbohydrate, proline, chlorophyl A, B, carotenoid were observed in comparison with trees in the unpolluted regions. The morphological characters such as leaf area showed decrease. *(Journal of Plant Sciences 4 (4): 122-126, 2009;* ***doi:*** *10.3923/jps.2009.122.126)*

## Ethnobotanical Utilization and Conservation of Chewing Sticks Plants Species in Ekiti State, Nigeria

Joshua Kayode and Michael A. Omotoyinbo

Surveys and direct field observation were carried out to determine the endangered chewing stick species in Ekiti State, Nigeria. The survey involved the use of semi-structured interviews which were conducted with a fairly open framework that allowed for focused, conversational and two-way communication. Also group interviews were conducted in order to determine group consensus on the chewing

sticks plant species. The relative abundance of the identified species was determined by the time it would take to physically come across the plant specimen in the study area. Results obtained revealed that a total of 49 plant species belonging to 28 different families were observed to be in use as chewing sticks. Most of these species were indigenous species; previous studies had revealed that these species were essentially rich in various natural products. The relative abundance test revealed that, 33, 51 and 16%, respectively, of the chewing sticks species were presently common, frequent and occasional on the abundance scale used in this study. Most of the species were uncultivated species whose wildlings were usually preserved in the study area and were in high demand in the study area. Other products widely derived from these species in the study area were identified. Thus the endangered species required urgent conservation efforts. Features that could enhance their conservation in the study area were defined. *(Research Journal of Botany 4 (1): 1-9, 2009; **doi:** 10.3923/rjb.2009.1.9)*

## Induction of Seed Germination in *Cistus heterophyllus* (Cistaceae): A Rock Rose Critically Endangered in Spain

José A. Navarro-Cano, Diego Rivera and Gonzalo G. Barberá

Seed germination from the only European population of the Iberian-North African endemism *Cistus heterophyllus* Desf. was studied by using germination inducing pretreatments. A seeding-cultivation method with flowerpots in a greenhouse was also tested and compared with the usual germination method using Petri dishes in a growth chamber. Seeds were collected in three different years. Germination percentages ca. 43% were obtained without pretreatment. This can be considered a high percentage in the genus *Cistus* and abnormally large for an isolated population composed by only nine individuals. A large variability in seed germination was found among the samples from the same population collected in different years. The dry-heat pretreatment (87±3ºC for 12 min and soaking in water at 20ºC for 48 h) significantly increased the germination percentage, reaching 81.5%. Germination in greenhouse was as effective as in growth chamber. The seeds maintained their viability until at least 6 years after collection and storage in a dry atmosphere at laboratory temperature. These results mean the first contribution to the germination ecophysiology of this species and they are fundamental to the recovery plan of the last remnant population of *C. heterophyllus* in Spain. *(Research Journal of Botany 4 (1): 10-16, 2009; **doi:** 10.3923/rjb.2009.10.16)*

## Taxonomic Significance of Foliar Epidermis in Some Members of Euphorbiaceae Family in Nigeria

D.O. Aworinde, D.U. Nwoye, A.A. Jayeola, A.O. Olagoke and A.A. Ogundele

A detailed morphological study of the leaf epidermis of the tropical genera of some species *Acalypha*, *Bridelia*, *Euphjorbia*, *Hura*, *Jatropha*, *Manihot* and *Ricinus* in Nigeria is presented. The study revealed several interesting epidermal features some of which have not previously been reported in the genera. Leaf epidermal characters such as pattern of epidermal cells, types of stomata and presence of trichomes are constant in some species and variable in others and thus of great significance in understanding the relationships between and within species. Leaves are amphistomatic in all species except in *Bridelia ferruginea*, *Euphorbia heterophylla*, *Euhorbia pulcherrima* and *Jatropha gossypifolia* which are hypostimatic. The stomata length, width, density and index also very in different species. *(Research Journal of Botany 4 (1): 17-28, 2009;* ***doi:*** *10.3923/rjb.2009.17.28)*

## Female Gametophyte in Two Kenyan Species of *Inversodicraea*- (Podostemaceae)

S. Sikolia and J.C. Onyango

This study aims to elucidate the ontogeny and organization of the female gametophyte. Further, provide evidences for the strike phenomenon in the Podostemaceae. The female gametophyte ontogeny in *Inversodicraea bifurcata* Engl. *I. keniensis* sp. nov. Nagendran et Sikolia conforms to the Apinagia type of the monosporic category. The primary chalazal nucleus degenerates at the two-nucleate stage. The strike phenomenon met in the family is discussed. The organized female gametophyte is four-nucleate, four-celled and consists of two pear shaped synergids, a large central egg cell and a polar cell. Filiform apparatus are present in the synergids. Based on the female gametophyte ontogeny, there are no antipodal cell(s). Earlier reports of double fertilization are not confirmed, but only single fertilization take place in the family. The nucellar plasmodium is rationalized on its organization and ontogeny and is formed before fertilization in *Inversodicraea*. Effects of tension force and lytic enzymes during nucellar plasmodium organization and its ultimate significance are discussed. *(Research Journal of Botany 4 (1): 29-39, 2009;* ***doi:*** *10.3923/rjb.2009.29.39)*

## Accumulation of Raphides Crystals in *Euterpe oleracea* Mart. Embryo

M.A.M. Neto, A.C. Conceição, A.S. Mendes, R.C.L. Costa and A.K.S. Lobato

The aim of this study was to determine if the crystals of the calcium oxalate present in the *Euterpe oleracea* embryo has function of calcium reserve during the germination process and if the accumulation is dependent of fruit production. In the experiment 1 the design was entirely randomized, with 3 evaluation periods (September, November and December). In the experiment 2 the design was entirely randomized, with 3 treatments (without cultivation, MS-$CaCl_2$ after 30 cultivation days and MS + $CaCl_2$ after 30 cultivation days). The results not confirm the function of calcium reserve of the raphides in *Euterpe oleracea* embryos, however was determined that the calcium oxalate crystals of the embryo are monohydrated and that the production and accumulation is dependent of the season, in which the accumulation is higher in the period of smaller fruit production. *(Research Journal of Botany 4 (1): 40-47, 2009;* ***doi:*** *10.3923/rjb.2009.40.47)*

## An Illustrated Description of *Selaginella imbricata* and *Selaginella yemensis* from Saudi Arabia

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*Selaginella imbricata* (Forssk) Spring and *Selaginella yemensis* (Swart) Spring, are described in detail in light of numerous recent collections from Saudi Arabia. The two species are recorded for the first time in El-Baha region and Shammaran and Muhayl valley of Asir region. The two species are investigated and compared with those of other countries. A key to the two species is providing. The presence of *Selaginella* species in five different localities in Saudi Arabia indicates that the species are native and not invasive plants. *(Research Journal of Botany 4 (1): 48-54, 2009;* ***doi:*** *10.3923/rjb.2009.48.54)*

## Phytosociological Investigation and Life Form Pattern of Grazinglands under Pine Canopy in Temperate Zone, Northwest Himalaya, India

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In temperate region of Northwest Himalaya, drier slopes are dominated by *Pinus roxburghii* and are known for rich ground herbaceous flora predominated by

grasses. These regions serve as grazingland for livestock and cattle. Present study deals with vegetation analysis, phytosociology and life form pattern of such grazingland between 1100-1400 m a.s.l. across the altitudinal gradient and varying slopes. *Capillipedium parviflorum* is identified as dominant species based on Importance value index, although the area is exhibited by large number of herbs in comparison to grasses and sedges. Vegetation of the area is contagiously distributed and predominantely represented by therophytes and geophytes indicating the degree of anthropogenic activities. The native vegetation is disturbed by overgrazing and life forms of the flora of each of the association are maintained by the intensity of grazing. In the sites under observations, besides grazing, fire was main detrimental factor for dominating the flora by therophytes. Codominance of geophytes may be assigned to its propagation through underground perennating organs as the fire type in these ecosystems is crown fire type. The study describe all these features.*(Research Journal of Botany 4 (2): 55-69, 2009; **doi:** 10.3923/rjb.2009.55.69)*

## Rapid and Efficient Method of Genomic DNA Extraction from Pistachio Trees (*Pistacia vera* L.)

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This study was conducted to develop a rapid and efficient protocol for extracting high quality DNA from Pistachio trees suitable for PCR and molecular studies. Genomic DNA was extracted from 12 Pistachio trees using modified QIAGEN DNeasy Plant Mini Kit. The results showed that the modified protocol successfully produced a sufficient amount of DNA with high quality, which was highly confirmed by the purity index values of DNA samples (1.45 to 2.01). In conclusion, the modified protocol can produce high quality DNA from Pistachio trees suitable for PCR studies such as RAPD and AFLP and it can be easily adjusted for other *Pistacia* species. *(Research Journal of Botany 4 (2): 70-73, 2009; **doi:** 10.3923/rjb.2009.70.73)*

## Cryopreservation of *Brassia rex* Orchid Shoots Using PVS2 Technique

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*In vitro* grown shoots of *Brassia rex* orchid hybrid was cryopreserved by means of plant vitrification solution 2 (PVS2) technique. For the preculture treatment, the shoots were excised into two standard sizes of 0.5-1.0 and 1.0-1.5 cm and were

precultured on half-strength Murashige and Skoog (MS) semi solid medium supplemented with different concentrations of sucrose (control (0.06 M), 0.1, 0.25, 0.5 and 0.75 M) for 24 and 48 h. For the PVS2 dehydration treatment, the 0.1 M precultured (48 h and 1.0-1.5 cm) shoots were chosen for further experiment where the shoots were dehydrated in PVS2 solution at various durations (5, 10, 15, 20, 25 and 30 min) at 0 and 24°C for positive and negative storage in Liquid Nitrogen (LN). The viability of the cryopreserved cells were determined by 2, 3, 5-triphenyltetrazolium chloride (TTC) assay and chlorophyll extraction techniques. The best condition of PVS2 treatment was at 20 min of PVS2 treatment at 0°C prior to storage in liquid nitrogen. In chlorophyll determination based on chlorophyll assay, the highest concentration of total chlorophyll concentration (56.250 μg $g^{-1}$) was obtained from shoots that were dehydrated for 25 min in PVS2 solution at 0°C without storage in liquid nitrogen. *(Research Journal of Botany 4 (3): 74-88, 2009;* ***doi:*** *10.3923/rjb.2009.74.88)*

## Genetic Diversity of Indian Liverwort *Plagiochasma appendiculatum* Revealed by RAPD Marker

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Genetic diversity of the Monoceious thalloid liverwort *Plagiochasma appendiculatum* was investigated by Rapid Amplified Polymorphic DNA (RAPD) analysis. The species is explained and demonstrated with its genetic diversity on the basis of morphological variations. Samples were collected from different parts of India growing on different habitat at variable altitude. After the study of its morphology, it has been observed that the population of this taxon shows significant variation in plant size, shape, colour, ventral scales, appendages of scales, rhizoids, position of male and female receptacles etc. Based on such morphological variations, we have used the RAPD marker to estimate the genetic diversity within and between the populations. Approximately 75% of the variations have been observed within and between genotypes of *P. appendiculatum* as revealed with both phenotypic and genotypic data. The RAPD markers are being used increasingly to analyze the phylogenetic relationship among the liverworts to give the exact framework of taxonomic identification of naturally occurring liverwort *P. appendiculatum. (Research Journal of Botany 4 (3): 89-100, 2009;* ***doi:*** *10.3923/rjb.2009.89.100)*