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On Methods Derived from Hansen-Patrick Formula for Refining Zeros of Polynominal Equation

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(received March 29, 2004; revised March 28, 2005; accepted March 31, 2005)

Abstract. A one-parameter family of iteration functions as derived by Hansen and Patrick (1977) was studied. The Halley's method was of particular interest, which was modified by using the Taylor polynomial equation of order two to obtain the well-known Chevbyshev's iteration formula. Further, using the Laguerre's disk, two new methods were constructed out of the Chevbyshev's functional iteration fomula. The obtained methods may, and often will, depend on the already calculated values.

Keywords: Hansen-Patrick formula, binomial series, Taylor polynomial equation, Laguerre's disk, polynomial zeros, Chevbyshev's functional iteration

Studies of Molecular Interactions of α -Amino Acids in Aqueous and Cationic Surfactant Systems Investigated from Their Densities and Apparent Molal Volumes at 283.15, 288.15 and 293.15 K

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Abstract. Density ($\rho/10^3 \text{ kg m}^{-3}$) and molal volumes ($V_\phi/10^{-6} \text{ m}^3 \text{ mol}^{-1}$) of glycine, valine and leucine from 0.03 to 0.07 mol kg^{-1} , and cetyl pyridinium chloride (CPC) and cetyl pyridinium bromide (CPB) were measured in 0.0497 mol kg^{-1} aqueous surfactant solution systems at different temperatures. The data were regressed against molality, and constants were referred to as the limiting density (ρ^0) and apparent molal volumes (V_ϕ^0) and denoted as solute-solvent interactions, while their slope constants indicated molecular interactions and influence of composition. It was observed that amino acids with a shorter alkyl chain, such as glycine, had weaker affinity to interact with cationic surfactants, in comparison with the longer alkyl chain amino acids, such as leucine. The CPB with larger-sized anion showed greater molecular interaction with amino acids.

Keywords: pyridinium ring, intermolecular forces, hydrophobic interactions, transfer volume, cationic surfactants

Liquid-Liquid Equilibrium Data of Ternary Systems of Water, Acetic Acid and Alkanols (1-Butanol, 1-Pentanol and 1-Hexanol)

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(received August 17, 2004; revised March 8, 2005; accepted March 22, 2005)

Abstract. The liquid-liquid equilibrium data are presented for phase behaviour of ternary system of water, acetic acid and alkanols (1-butanol, 1-pentanol and 1-hexanol) at the temperature of 30 ± 0.1 °C. From the data, binodal curves, tie lines, plait points and equilibrium distribution diagram were determined experimentally, and the distribution coefficients and separation factors were computed, with a view to examine the suitability of alcoholic solvents to extract acetic acid from its aqueous solution. It has been found that the solubility of acetic acid increased with the increasing number of carbon atoms in the chain of the alcohol used as the solvent, giving higher values of distribution coefficients and the separation factor.

Keywords: liquid-liquid equilibrium, tie line, liquid-liquid extraction, phase behaviour, distribution coefficient, acetic acid extraction, binodal curve, equilibrium distribution

Synthesis and Antimicrobial Activity of Some Heterocycles: Part-V

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(received November 21, 2003; revised July 20, 2005; accepted July 23, 2005)

Abstract. *Ortho*-aminonitrile (**1**) was prepared from ethoxymethylenemalononitrile. 4-Allylamino-1-methyl-6-methylthiopyrazolo[3,4-d]pyrimidine (**4**) was prepared by an initial treatment of compound (**1**) with carbon disulfide in pyridine followed by methylation with methyl iodide and subsequent reaction with allylamine in acetonitrile. *Ortho*-aminoester (**5**) was prepared from ethyl (ethoxymethylene) cyanoacetate. Reaction of compound (**5**) with formamide yielded compound (**6**), which was then tosylated. All compounds were screened for their antibacterial and antifungal activities.

Keywords: ethoxymethylenemalononitrile, pyrazolo[3,4-d]pyrimidine, antimicrobial activity, synthesis of heterocycles

Combined Aerobic and Physicochemical Treatment of Pharmaceutical Industry Sludge

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(received September 9, 2003; revised July 8, 2005; accepted July 23, 2005)

Abstract. Composite samples of sludge obtained from a pharmaceutical factory were analysed for their pollution characteristics. The samples were then treated by integrated aerobic biological and physicochemical methods. The analysis revealed that the BOD and COD of the sludge liquor were high, as well as were the levels of solids concentration, nitrogen, phosphorus and bacterial count. These showed that sludge from this industry had a high pollution potential, and therefore needed treatment before disposal or reuse in other applications. Percentage solids reduction achieved were in the range of 26.1 to 29% of total soluble solids, 26.1 to 33% of suspended solids, and 43 to 52% of volatile solids. BOD and COD reductions were in the range of 96.1 to 98.2%, and 96.8 to 98.4%, respectively. Ammonia nitrogen reductions in this sludge were about 85.2 to 93.3%. Total nitrogen and phosphorus were also found to be appreciably reduced by the combined aerobic and physicochemical treatment methods.

Keywords: aerobic biodegradation, physicochemical degradation, pollution, wastewater treatment, eutrophication, pharmaceutical sludge

Essential Oil Composition of Green Peel of the Inter-Varietal Mandarin Hybrid, Kinnow Orange

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(received October 17, 2003; revised May 25, 2005; accepted May 25, 2005)

Abstract. The essential oil of green peel of large-sized Kinnow fruits was obtained by steam distillation, which recorded a yield of 0.34%. Kinow is a hybrid of inter-varietal cross of the mendarin orange cultivars, King x Mediterranean. The oil was analyzed by GC and MS procedures. Among a variety of the oil constituents, 24 compounds were identified by GC, which were further analyzed for their chemical nature through GC-MS. The major proportion of the indentified constituents comprised of 6-methyl-5-heptene-2-one (15.33%), carvone (13.8%), *cis*-carveol (10.04%) and thujanol (4.55%). Rest of the twenty identified compounds occurred in minor amounts, comprised of 35.84% of the total oil. Limonene, usually the major component of the citrus oils (35-85%), was present in rather low quantities (2.76%) in the Kinnow orange green peel oil.

Keywords: essential oils, limonene, Kinnow orange, Rutaceae, green orange peels, *Citrus reticulata* var. Kinnow

Biochemical Changes Induced in Some Rabbit Tissues on the Administration of an Antimalaria Drug, Fansidar

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(received January 7, 2004; revised July 4, 2005; accepted July 23, 2005)

Abstract. The effect of Fansidar (40 mg/kg), a widely used antimalaria drug, was investigated on enzyme activities and some other biochemical constituents in some selected rabbit tissues. The enzymes assayed were alanine transaminase, aspartate transaminase and alkaline phosphatase. Total protein and glucose contents in the tissues were also determined. The results obtained showed a decrease in the activities of alanine transaminase and aspartate transaminase in liver and heart when the drug was administered. This indicates tissue damage, which was complicated with an increase in the activities of these enzymes in the blood due to cell leakage. There was a significant elevation of alkaline phosphatase activity in liver, heart and blood, on the third day of drug administration, which continued upto the seventh day only in the heart. This shows that prolonged usage of the antimalaria drug, Fansidar, may lead to cell destruction and degradation.

Keywords: antimalaria drug, Fansidar, alanine transaminase, aspartate transaminase, tissue damage, alkaline phosphatase

Interspecific Variations in the Fecundity of Some Dominant Fish Populations in Ikpoba River, Nigeria

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(received February 4, 2003; revised August 8, 2005; accepted August 18, 2005)

Abstract. Interspecific variability and trends in the fecundity of five dominant fish species, namely, *Auchanoglanis occidentalis* (Bagridae), *Brycinus longipinnis* (Characidae), *Tilapia mariae* (Cichlidae), *Malapterurus electricus* (Malapteruridae), and *Xenomystus nigri* (Notopteridae) from Ikpoba river were studied, vis-à-vis certain morphological attributes. Estimates of the “b” value (regression coefficient; exponent of length-fecundity relationship) ranged between 0.301 in *T. mariae* and 3.265 in *A. occidentalis* with a mean of 1.850. The maximum size of the fish populations examined did not significantly influence the relative magnitude of “b” (regression coefficient). The parameter β of the linear length-fecundity (LF) relationship of the form $F = \beta L^b$ are also presented. Estimates of β (slope of regression coefficient) ranged from min 2.18 in *X. nigri* to max 142 in *M. electricus*. LF data in this study suggested that absolute fecundity of the fish populations was dependent on the cube of their length, and hence body volume. There was a positive allometric functional relationship between the mean total body weight, mean body condition and mean absolute fecundity ($p < 0.05$). The mean absolute fecundity varied considerably among the families (coefficient of variation, $cv = 74.04\%$). The decreasing order of variance of the mean for absolute fecundity was *M. electricus* > *T. mariae* > *B. longipinnis* > *A. occidentalis* > *X. nigri*. The hierarchy of mean absolute fecundity was *B. longipinnis* > *M. electricus* > *T. mariae* > *A. occidentalis* > *X. nigri*. There was no significant relationship between the mean absolute fecundity and mean total length ($p > 0.05$). Interspecific divergence in fecundity and morphometric attributes of these species ($cv = 18.8-89.20\%$) appeared to enhance reproduction isolation or partitioning. This explains, in part, the reason for sustainable coexistence of these fish species within the same habitat in Ikpoba river.

Keywords: interspecific variation, fish fecundity, Ikpoba river, length-fecundity relationship, inland fishery

Numerical Taxonomy of Two New Mite Species of the Genus *Caloglyphus* Berlese (Acaridae) from Pakistan

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(received April 30, 2004; revised May 7, 2005, accepted August 18, 2005)

Abstract. During the mite sampling of the genus *Caloglyphus*, the taxonomical analysis of diagnostic features of the hypopial stage confirmed two new taxa named as *C. agrios* and *C. hadros*. When compared with the already known worldwide species within this genus, these species showed sufficient dissimilarity to be classified as separate taxa. The characteristic features differentiating these new species from the other *Caloglyphus* species are the shapes of gnathosoma, propodosoma, hysterosoma, apodemes, coxal fields, suctorial shield, and chaetotaxy and solenidiotaxy of legs. The present study reports the historical review of the genus, completed with the information on already known species, their description, illustration of main characters, geographical distribution, host range, remarks on the new species, matrixes showing comparisons, and the percentage of similarity along with a key for their identification based on hypopial characters for the species known from Pakistan.

Keywords: new mite species, *Caloglyphus*, mite taxonomy, *Caloglyphus agrios*, *Caloglyphus hadros*, Acaridae, hypopus

Cause and Effect Relationship for Some Biometric Traits in Bread Wheat

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(received July 27, 2004; revised June 6, 2005; accepted August 31, 2005)

Abstract. Genotypic and phenotypic correlations and path coefficient analyses were conducted for grain yield and some biometric traits in 25 cross-combinations of bread wheat under the rainfed conditions. Significant positive genotypic and phenotypic association was observed between grain yield per plant, and the yield components, such as productive tillers per plant, spike-length, spikelets per spike, grains per spike and 1000-grain weight. The path coefficient analysis revealed that the number of grains per spike and 1000-grain weight had the maximum direct effect on grain yield. These traits may be considered as the selection criteria for developing high yielding wheat genotypes for rainfed areas.

Keywords: bread wheat, biometric traits, grain yield, correlation coefficient, path coefficient analysis, rainfed wheat crop

Combining Ability Analysis of Seed Cotton Yield and its Components in Cotton (*Gossypium hirsutum*)

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(received November 10, 2003; revised August 10, 2005; accepted August 13, 2005)

Abstract. In order to examine the genetic mechanisms controlling seed cotton yield and its components, four lines of *Gossypium hirsutum* L., MNH-554, Delcerro, Coker-304 and Albacala-(71)1190 were crossed in all possible combinations. Combining ability analysis of the data revealed that general combining ability effects were highly significant at $p = 0.01$, in respect of the number of bolls, seed cotton yield and lint percentage. The general combining ability variances were greater than specific combining ability variances, which showed the predominance of additive gene effects. Among the four parents, MNH-554 appeared to be the best general combiner for all the characters studied. Due to the preponderance effects of additive genes, it seems that single plant selection in segregating generations would be effective for improving the seed cotton yield and its various components.

Keywords: combining ability, *Gossypium hirsutum*, seed cotton yield, additive variance

Effect of Storage Fungi on the Seed Quality Parameters of Different Mustard Varieties

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(received May 29, 2004; revised November 30, 2004; accepted January 15, 2005)

Abstract. Seven seed storage fungi (*Aspergillus flavus*, *Alternaria brassicae*, *Helminthosporium brassicae*, *Penicillium* sp, *Pythium* sp, *Rhizoctonia solani* and *Fusarium oxysporum*) were isolated from four mustard seed varieties (B-ray, Y-ray, B-M-1 and S-9). *A. flavus* was the most predominant fungus found on seeds of all the four mustard seed varieties. The germination percentage of the fungal infected seeds of B-ray decreased significantly, followed by Y-ray, B-M-1 and S-9 mustard seed varieties, both in the laboratory and the pot-scale studies. It was noted that weight and oil contents of seeds of all the four varieties decreased in those that were infected by fungi during storage in comparison with the seeds that were stored in sterilized bottles. The fungal infected seeds also had lower glucosinolate and erucic acid contents than those of the non-infected seeds.

Keywords: storage fungi, mustard seed, seed quality parameters, glucosinolate in mustard, erucic acid in mustard, stored seed germination

Short Communication

Evaluation of Commercial and Candidate Bread Wheat Varieties for Durable Resistance to Rusts in Pakistan

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(received June 22, 2003; revised May 26, 2005; accepted July 26, 2005)

Abstract. Commercial and candidate bread wheat varieties were evaluated for durable resistance to rusts. The candidate varieties included genotype lines from the National Uniform Wheat Yield Trial, including Rainfed, Normal and Short trial programmes. A total of 89 genotype entries were evaluated. The evaluation was done on the basis of well recognized visual phenotype marker, the adult plant leaf tip necrosis. It was noted that 64% of the genotype varieties expressed this phenotype marker.

Keywords: bread wheat, candidate wheat varieties, rust resistance, wheat rusts

Short Communication

Multiple Shoot Bud Formation and Plantlet Regeneration from *in vitro* Cultured *Pistacia vera* Seeds

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Abstract. Studies were carried out on the primordial initiation and development of shoot buds derived from pistachio (*Pistacia vera*) seedlings, cultured on MS medium with added 6-benzylaminopurin (BA). The *in vitro* culture of pistachio seeds in the presence of BA (1.0 - 4.0 mg/l), plus kinetin (Kin, 1.0 mg/l) and naphthalene acetic acid (NAA, 0.25-1.0 mg/l) stimulated varying degree of seed germination and the number of shoots produced. When excised single shoots from these *in vitro* cultured seeds were subcultured on fresh medium containing high concentration of BA (4.0 mg/l), alongwith Kin and NAA, multiple shoot production was observed. Normal bud growth and shoot elongation were achieved by transferring cultures to the MS medium containing low concentration of the growth regulators BA (1.0 mg/l), plus NAA (0.25 mg/l) and Kin (1.0 mg/l).

Keywords: *Pistacia vera*, pistachio plantlet regeneration, multiple shoot formation, *in vitro* seed culture, primordial initiation
