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OPTICAL PROPERTIES OF AMORPHOUS AND A1-TYPE ANTIMONY TELLURIUM AND IODINE

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(Received August 12, 1979; revised December 17, 1979)

Measurements were made of reflectance, transmittance and coating thicknesses of optical systems consisting of glass substrates coated at 4.2°K with amorphous Sb, Te or I single layers or with B1-type CaO base films and A1-type Sb, Te or I pseudomorphic overlays. A combination of the measured values allowed us to determine the optical constants and the reflectance of amorphous and A1-type Sb, Te and I. The results obtained in the 0.6–4 μ spectral interval (corresponding to the 2.07–0.31 eV photon energy range) for films thicker than 70 nm (where size effects were found to vanish) are presented and discussed here. Let us emphasize that the amorphous phase exhibits semimetallic (Sb) or semiconducting (Te and I) behaviour, whereas the A1-type modification behaves in typically metallic fashion.

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THE CHEMICAL EFFECTS OF ALPHA DECAY IN U^{235} COMPLEX IONS

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(Received April 30, 1979)

The chemical effects of nuclear transformation associated with alpha decay of U^{235} have been studied in the U^{235} (IV) polyaminopoly carboxylic acid complexes of EDTA, DCTA, and DTPA. The observed break up values lie between a minimum of zero and a maximum of around 40%. These break-up values are dependent on certain ranges of pH and a different pH range is observed for each of the three complex systems studied. The addition of KI, a reducing agent, and an increase of U(IV) concentration (about 7 times its concentration in the other experiments) to investigate any reducing effect of U(IV) ion itself, does not alter the break-up value. The freezing of the reaction mixture, however, enhanced the break-up value to 56%. Considering the high recoil energies available following the alpha decay of U^{235} the break up values are thought to be low. It has been suggested that the possible localised oxidation of the U(IV) complex caused by the radiolysis products of water and the reducing effect of U(IV) ions, is responsible for the release of free ligand ions and the ultimate recombination with the daughter atoms, resulting in low break-up values.

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HEATS OF FORMATION OF Zn(II), Al (III) AND B(III) PHOSPHIDES

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(Received August 15, 1979; revised September 13, 1979)

The heats of combustion of zinc phosphide, aluminium phosphide and boron phosphide have been determined using oxygen bomb calorimetric techniques. Also the heats of combustion of mixtures of red phosphorus and the corresponding metals (Zn, Al and B), in the stoichiometric ratios as found in each phosphide were determined. From these data, the following heats of formation in kcal/mole, of the respective phosphides have been computed at ca.298°K :

Zinc phosphide, Zn_3P_2, $\Delta H_{298}^{o} = -90.3 \pm 5.2$; aluminium phosphide, AlP, $\Delta H_{298}^{o} = -29.0 \pm 1.7$; boron phosphide, BP, $\Delta H_{298}^{o} = 60.2 \pm 4.6$..

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MICROBIAL CHEMISTRY

Part III. Isolation and Identification of the Metabolic Products of *Penicillium funiculosum* Thom*. The Chemistry of Funiculosic Acid

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(Received May 19,1979; revised July 5, 1979)

Penieillium funiculosum Thom, grown on a semisynthetic medium has been shown to produce diethyl phthalate and a phthalaldehydic acid, $C_9H_8O_5$, for which the name funiculosic acid has been proposed. The chemistry of funiculosic acid (II) has been investigated and its synthesis achieved.

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DIFFERENTIAL THERMAL ANALYSIS OF TETRAALKYLAMMONIUM HALOBORATES

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(Received March 22, 1979; revised September 13, 1979)

DTA of a series of compounds of the type $R_4N^+BX_4^-$ (where R = Et or n-But and X = Cl, Br, Ph or $PhCl_2$) indicates the formation of trialkylamine trihaloboranes and dialkylamino dihaloborenes as intermediates in the formation of linear polymers instead of cyclic borazines as the end-products.

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ELECTRON-IMPACT INDUCED FRAGMENTATION OF 1:1 COMPLEX IN BORON–NITROGEN COMPOUNDS

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(Received April 29, 1979)

The species produced from the electron-impact induced fragmentation of 1:1 complexes of trialkylamines and haloboranes have been examined. However, when the same treatment is carried out with triethylamine borane complex some other species also appear.

Biological Sciences Section

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BIOSYNTHESIS OF ENZYMES BY SOLID SUBSTRATE FERMENTATION*

Part II. Production of Alpha-Amylase by *Bacillus subtilis*

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(Received May 3, 1979; revised October 16, 1979)

Production of alpha-amylase by the locally isolated cultures of *Bacillus subtilis* was studied using wheat bran as solid substrate in conical flasks. The selected culture was improved by UV irradiation. Partial replacement of wheat bran by other substrates such as rice husk, maize bran, peanut meal or penicillium-waste mycelium was also investigated for enzyme formation. Of all the substrates wheat bran was found to be an ideal for enzyme synthesis.

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SOME ASPECTS OF THE BIOLOGY AND ECOLOGY OF *ZYGINA RUBRONOTATA* A PEST OF FALSA *(GREWIA ASIATICA)* IN PAKISTAN*

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(Received November 30, 1978; revised November 10, 1979)

Zygina rubronotata (Distant) is a serious pest of the fruit plant falsa *(Grewia asiatica)* in some areas of lower Sind in Pakistan. Studies made on different aspects of the biology and ecology of the species showed that it is usually found on falsa from September to February, with peak population during December. The life span of the species from September to February for a male ranged from 5 to 15 ($\overline{X}$ 9) days, and for females from 13 to 42 ($\overline{X}$ 27.2) days. The newly emerged adults mated and female started laying eggs within 4–6 days. In the life history studies, the average life of female, incubation period of eggs, duration of first, second, third, fourth and fifth nymphal instars were, 12.8, 7.1, 2.8, 2.5, 2.1, 1.7 and 1.4 days respectively. The oviposition period of a female was 4 – 14 ($\overline{X}$ 8) days, and the eggs laid were 16 – 44 ($\overline{X}$ 31.33).

The leafhopper affects the foliage of plants by sucking the nutrients as well as attracting growth of fungus *Phakopsora grewiae* (brown dust) in the vicinity of feeding punctures. From early September, the destruction of foliage progressively increased from almost nil to a complete 'defoliation' (99% damage) by the end of February. The studies have been supported with data in 4 tables, and illustrated with 5 figures.

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DIVERSITY OF TYPHLOCYBINE LEAHOPPERS AFFECTING FRUIT PLANTS IN PAKITAN*

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(Received March 29, 1979; revised October 7, 1979)

A brief survey of typhlocybine leafhoppers was carried out to ascertain the species affecting fruit plants in Pakistan. Two hundered and eighty-six standardised samples were collected from different areas of the country, which showed forty-three species of leafhoppers harboured by twenty species of fruit plants. Leafhopper species turned out to be important included *Emposasca punjabensis, Typhlocyba quettensis, Typhlocyba javedi, Empoasca persicae, Erythroneura vinealis* and *Zygina rubronotata* affecting plants like apple, grape vine, peach, apricot and grewia in the country.

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ABUNDANCE AND DIVERSITY OF TYPHLOCYBINE LEAFHOPPERS ON VEGETABLE PLANTS IN PAKISTAN

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(Received April 22, 1979; revised October 10, 1979)

A brief survey of typhlocybine leafhoppers affecting vegetable plants was made in Pakistan. The results of 1493 samples collected indicated that nearly 39 species of leafhoppers infested 37 species of vegetable plants . Of these the plants observed seriously affected were potato, pumpkin, spinach, carrot, bitter gourd, brinjal, chillies, okra, turnip, tomato and sugarbeet. Emerging out as the most important species in these studies were *Empoasca punjabensis* which affected 35 out of 37 plants species of vegetable plants.

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CHLOROPHYLL LOSS IN LEAVES OF SOME PLANTS CAUSED BY LEAFHOPPER FEEDING*

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(Received May 31, 1979; revised November 21, 1979)

In order to determine the effect of leafhopper feeding and chlorophyll loss, studies were made on three different species, two typhlocybines and one idiocerine feeding on bauhinia, grewia and mango respectively. The chlorophyll loss turned out to be as high as 71% from the leaves, resulting into almost functional death of leaves. It was also assessed that the chlorophyll loss in leaves was proportional to the number of leafhoppers feeding. In case of typhlocybines the leaf areas affected were visible by white stippling marks, whereas in case of idiocerine leafhopper the stippling marks are not visible, but the chlorophyll is lost as usual during leafhopper feeding.

Technology Section

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TALC-CHLORITE ROCKS IN ATTOCK SLATES

M.A. Qaiser, M. Alauddin, S.M. Akhter and Ainul Hasan Khan

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(Received November 30, 1978, revised September 24, 1979)

Dark grey to whitish rocks from Attock Khurd, previously described as low grade soapstone, were found to contain talc with a subordinate amount of chlorite (penninite). Other impurities are quartz, calcite, dolomite, magnesite and pyrite. The mineral assemblage has in all probability resulted from magnesium-containing solution of hydrothermal origin acting on illite of the slate.

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EFFECTS OF HERBICIDES ON THE RATE OF GERMINATION AND RESPIRATION OF COTTON SEEDS

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(Received February 15, 1979; revised October 16, 1979)

Delinted seeds of *Gossypium hirsutum* L. cv. M-100 were treated with prometryne, cotoron and their mixture (1:1). Percentage germination and rate of respiration were recorded after regular intervals.

A highly significant increase in the rate of respiration was found to be associated with a markedly reduced percentage of germination as a result of cotoron application. Results obtained from the mixture were significant at $P < .05$, whereas the effect of prometryne was insignificant on either parameters.

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STUDIES ON THE ESSENTIAL OILS OF THE PAKISTANI SPECIES OF THE FAMILY UMBELLIFERAE

Part XLIII. *Ligusticum elatum* Clarke (Shangatay) Seed Oil

Muhammad Ashraf, Patrick J. Sandra*, Talat Saeed* and Muhammad Khurshid Bhatty

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(Received September 24, 1979)

A study on the essential oil obtained from the fresh mature seed of the indigenous *Ligusticum elatum* has been conducted with respect to its physicochemical characteristics and chemical composition. The oil with a yield of 0.21% is constituted of santene (0.18%), α-pinene (10.85%), camphene (3.76%), sabinene (6.33%), β-pinene (4.25%), myrcene (3.94%), β-phellandrene (0.42%), α-terpinene (0.15%), *p*-cymene (0.24%), limonene (8.82%), 1,8(9)-*p*-menthadiene (0.24%), γ-terpinene (0.27%), bornyl acetate (0.36%), linalool (0.8%), anethole (0.27%), borneol (0.42%), thujyl alcohol (0.45%), carveol (0.15%), caren-*cis*-4-ol (0.15%), dihydrocarveol (0.16%), phenyl ethyl alcohol (0.60%), β-caryophyllene (0.46%), β-elemene (2.02%), β-sesquiphellandrene (8.31%), *trans*-β-farnesene (0.52%), β-bisabolene (4.69%), β-gurjunene (2.72%), α-curcumene (0.72%), γ-bisabolene (5.06%), bergamotene (0.63%), bisabolene (3.37%), α-gurjunene (0.42%), α-farnesene (0.42%), α-bulnesene (0.96%), α-humulene (0.85%), β-selinene (1.27%) and ambrettolic acid (13.38%). The presence of ambrettolic acid in such a large amount in the essential oil of an Umbelliferae species is an interesting finding.

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STUDIES ON THE ESSENTIAL OILS OF THE PAKISTANI SPECIES OF THE FAMILY UMBELLIFERAE

Part XLIV. *Selinum candollei*, DC (Theem) Seed Oil

Muhammad Ashraf, Talat Saeed,* Patrick J. Sandra,* G. Rabbani Khan and Muhammad Khurshid Bhatty

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(Received September 24, 1979)

The essential oil steam-distilled from the seed of *Selinum candollei* has been characterised and studied for its physicochemical properties and chemical composition. The oil obtained in 1.5% yield is composed of 2,3-dimethyl-3-ethyl pentane (0.24%), α-thujene (0.20%), α-pinene (0.69%), phenyl methyl ketone (0.08%), santene (0.12%), 1-methyl-4-isopropenyl bensene (0.12%), salinene (1.04%), 2, 4-dimethyl hexane (0.03%), β-pinene (0.57%), myrcene (3.88%), n-undecane (1.88%), γ-terpinene (0.25%), *p*-cymene (9.00%), Δ^3-carene (5.34%), β-phellandrene (19.12%), sabinene (0.49%). 1-methyl-4-isoproyl-1, 4-cyclohexadiene (0.15%), 1,8-cineole (0.36%), 2-methyl nonane (1.65%), *o*-cymene (0.37%), n-dodecane (1.22%), verbinone (0.43%), fenchone (0.55%), cinnamaldehyde (0.28%), carvone (0.42%), anethole (0.98%), thymol (0.98%), borneol (0.73%), cuminyl alcohol (0.24%), neo-isothujyl alcohol (3.45%), methyl eugenol (0.41%), longifolene (0.49%), β-bourbonene (0.73%), alloaromandrene (0.84%), β-caryophyllene (1.39%), khusilol (0.82%), *trans*-β-farnesene (8.90%), β-elemene (1.03%), β-bisabolene (1.02%), ϵ-murrulene (0.65%), 3-*m*-tolyl-2-propanol (2.04%), α-farnesenel (2.00%) and 5βH, 7β, 10α-selina-3, 11-diene (0.18%). The essential oil of *Selinum candollei* is mainly constituted of mono- and sesquiterpenes.

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STUDIES ON THE ESSENTIAL OILS OF THE PAKISTANI SPECIES OF THE FAMILY UMBELLIFERAE

Part XLV, *Ferula assafoetida*, Linn (Herra Hing) Gum Oil

Muhammad Ashraf, Rafi Ahmad, Shahid Mahmood and Muhammad Khurshid Bhatty

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(Received September 24, 1979)

The essential oil steam-distilled from the pure gum of *Ferula assafoetida* originating from the Baluchistan Province in Pakistan has been studied with respect to its physicochemical characteristics and chemical composition. The oil is obtained from the gum in 20.74% yield and has been found to be composed of α-pinene (14.3%), phellandrene (6.4%), secondary butyl propenyl bisulphide (51.9%), undecyl sulphonyl acetic acid (18.8%), an unidentified bisulphide (7.5%) and tarry material (1.0%). The essential oil possesses garlic-like flavour and it can be used in place of its gum which finds application in the preparation of some local dishes besides its unique medicinal value.

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STUDIES ON THE ESSENTIAL OILS OF THE PAKISTANI SPECIES OF THE FAMILY UMBELLIFERAE

Part XLVI. *Stewartiella baluchistanica*, E. Nasir, Oil of the Whole Plant

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PCSIR Laboratories, Lahore 16

(Received October 21, 1979)

The essential oil steam-distilled from the whole plant of *Stewartiella baluchistanica* has been characterised and studied with respect to its physicochemical properties and chemical composition. The oil obtained in 0.15% yield consisted of : methyl benzene (1.87%), ethyl benzene (0.09%), xylene (0.13%), pentyl benzene (0.09%), 2, 3-dimethyl-3-ethyl pentane (0.52%), linalyl acetate (traces), methyl ethyl benzene (traces), 4-Tr-butyl cyclohexane (traces), *trans*-sabinone hydrate (0.07%), 2-methyl-4-hexyl hexanone (0.04%), isobutyl benzene (0.09%), phenyl methyl ketone (0.29%), *m*-menth-1,8(9)-diene-5-ol (0.08%), cumene (0.94%), n-decane (1.30%), methyl benzaldehyde (0.15%), 1-methyl-4-isopropyl-1,3-cyclohexadiene (0.15%), 4-ethyl-1-octyn-3-ol (0.09%), pinene-oxide (0.10%), limonene-4-ol (0.17%), isocarvomenthone (1.17%), *trans*-pinocarvone (0.34%), eucarvone (1.51%), verbinone (0.55%), pulegone (5.38%), dec-3-en-2-one (0.52%), dec-4-en-2one (0.44%), thymol (0.65%), *cis-p*-menthadiene-2, 8-ol-1 (3.71%), carveol (12.34%), chavicol (0.84%), β-terpinene-3,4-oxide (0.14%), 2-methyl terephthaldehyde (2.30%), sabinol (15.83%), trimethyl benzaldehyde (0.14%), γ-muurolene (7.23%), isolongifolene (0.10%), 1-phenyl-4-methyl-octane (0.19%), γ-cadinene (0.79%), α-cadinene (0.14%), β-bisabolene (0.55%), β-elemene (1.16%), β-selinene (1.08%), β-caryophyllene (0.03%), humulene (0.28%), pinocarveol (2.76%), methyl chavicol (3.49%) and some unidentified sesquiterpenes and phenolic components. The essential oil of the *Stewartiella baluchistanica* is unique among umbellifer because none of the members of the family has so far been reported to contain such a large number of components. One hundred and nine compounds have been detected in the oil and we have succeeded in identifying about fifty of these compounds. It will be quite interesting to study the physiological effect of the oil so as to introduce the species in the local materia medica.

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STUDIES ON THE ESSENTIAL OILS OF THE PAKISTANI SPECIES OF THE FAMILY UMBELLIFERAE

Part XLVII. *Angelica archangelica*, Linn. var. Himalaica (Clarke), E. Nasir, Seed Oil

Muhammad Ashraf, Rafi Ahmad, Shahid Mahmood and Muhammad Khurshid Bhatty

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(Received October 21, 1979)

A study upon the physicochemical characteristics and chemical composition of the essential oil distilled from the *Angelica archangelica* has been carried out. The percentage yield of the oil is 0.4% and its constituents are: α-pinene (11.4%), camphene (1.9%), limonene (0.8%), α-phellandrene (0.6%), β-phellandrene (2.1%), *p*-cymene (1.4%). β-caryophyllene (2.4%), β-bisabolene (1.5%), hexyl methyl phthalate (36.0%), an unknown acid (1.6%), a mixture of coumarins (18.1%), bergaptene (19.6%) and oxypeucedanin (2.6%). The major oxygenated component of the oil namely hexyl methyl phthalate is a new find in the essential oil of the Pakistani *Angelica archangelica* seed.

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FATTY ACID COMPOSITION OF *MELIA AZEDARACH* SEED OIL (BAKAIN)

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(Received August 11, 1979; revised November 22, 1979)

Fatty acid composition of the Bakain seed has been investigated. It was found to contain palmitic (6.93%), stearic (2.98%), oleic (8.2%) and linoleic (82.05%) acids. Possibility of its commercial exploitation has been discussed.

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COLOURED GLAZES BASED ON SURFACE CLAY

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Surface clay (red clay) has been used as a base for various coloured glazes such as yellow, brown, maroon, black and light blue, maturing between 1000^{o}–1100^{o}. Iron content of the clay has been utilized for developing these colours. Additional Fe_2O_3 and MnO_2 have been added for effecting desirable changes in the shade of some glazes.

Short Communication

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MARINE FISH NEMATODES OF PAKISTAN

Part XI. Occurrence of *Indocucullanus longispiculum* diacanthi in the Fish *Arius serratus* (Day) of Karachi Coast

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(Received March 11, 1979; revised September 24, 1979)

same and the genus is same. On the other hand one species by two different authors from two different localities and hosts is reported as two separate species. The author had discussed these points while reporting some trematodes of fishes [3,4].

At present the occurrence of *Indocucullanus longispiculum diacanthi* [2] is reported from the fish *Arius serratus* of Karachi coast and the validity of this subspecies is justified. This nematode was originally described from the fish *Pseudosciaena diacanthus* [2] from which closely related specimens *Indocucullanus longispiculum* [1] were reported by Khan [1]. The present findings indicate that constant occurrence of same morphological variations in a species, and occurrence of the same in different hosts can be used to justify the validity of a particular subspecies.