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COMPARATIVE MEASUREMENTS OF THE TEMPERATURE DERIVATIVES OF VISCOSITY, DENSITY AND REFRACTIVE INDEX OF PURE LIQUIDS AND SOLUTIONS

Part VI.—Dilatometric Measurements on n-Amyl Alcohol and Isoamyl Alcohol with 1°C Interval and in the Range of 20°C–70°C

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(Received April 30, 1969)

This communication presents refined measurements of coefficient of dilatation, \( \beta(=\frac{dV}{V},dT) \), with 1°C interval in the range of 10°C–70°C, on n-amyl alcohol and isoamyl alcohol. The variations in the value of \( \beta \) with temperature show a roughly sinusoidal component with an average cycle of 4.9°C and 5.3°C and an amplitude of 0.1 units of \( \times 10^{-4} \).

Comparison of the previously reported mean temperatures of minima in \( E/R \) and \(-\frac{dn}{dT}\) (cf. ref. 6) with temperatures at minima in the graphs of coefficient of dilatation show that there is reasonable one-to-one correspondence. the minima in \( E \) and \(-\frac{dn}{dT}\) being ahead of those in \( E/R \) and \(-\frac{dn}{dT}\) by 2.4°C±0.4°C, i.e. almost exactly half a cycle. Thus, the minima in \( E \) and \(-\frac{dn}{dT}\) correspond within the limits of present accuracy with the maxima in \( \beta \).

**Introduction**

The measurements of coefficient of dilatation, \( \beta \), on ethylene glycol reported in Part I of this series showed a sinusoidal behaviour with an amplitude of 0.1 \( \times 10^{-4} \) peak-to-peak, the minima agreeing within ±1°C with the temperatures of the known jumps in flow activation energy, \( E/R \). In Part II of this series, our measurements on pure benzene revealed a one-to-one correspondence between the oscillatory changes in \( \beta \) and \( E/R \), while the temperature derivative of refractive index, \(-\frac{dn}{dT}\), appeared to be out of phase by \( \pi/2 \). In succeeding publications from this laboratory, measurements of coefficient of dilatation on a series of aqueous ethanol solutions were reported, and graphs of \( \Delta \beta/\Delta T \) below 33°C, above which temperature the behaviour is not clear.

In the light of the above observations, it was considered worthwhile to look for such anomalies in other liquids as well, by undertaking measurements of refractive index and coefficient of dilatation. In Part V of this series, the measurements of \( E/R \) and \(-\frac{dn}{dT} \) on n-amyl alcohol, isoamyl alcohol and n-butyl alcohol revealed a probable interrelationship between the two quantities. The present paper reports refined measurements of coefficient of dilatation for n-amyl and isoamyl alcohol in the range of 10°C–70°C, and a comparison of this data with that on \( E/R \) and \(-\frac{dn}{dT} \) is made so as to elucidate the manner of their mutual correspondence.

**Experimental Details**

The method of obtaining the experimental values of coefficient of dilatation, \( \beta \), was the same as adopted in previously reported work on ethylene glycol. The dilatometer capillary was connected to a compensating bottle placed in the thermostatic bath along with the dilatometer bulb. Meniscus height of liquid in the dilatometer capillary was measured, at each temperature, against a standard attached steel scale with an accuracy of ±0.1 mm, and with temperature accuracy of ±0.002°C up to 45°C and ±0.005°C above 45°C after allowing sufficient time (about 1/2 hr) to ensure an equilibrium state to be attained.

Measurements were taken in groups covering successive ranges of 10°C, in case of n-amyl alcohol, where a dilatometer with a conversion factor of 1.71 \( (=\pi r^2/V) \) was used, and 5°C with isoamyl alcohol, where another dilatometer was used whose factor was 0.60, \( r \) and \( V \) being the mean radius of capillary and volume of dilatometer bulb, respectively. These groups were so arranged
COPOLYMERIZATION

Part II.*—Copolymerization of Acrylonitrile and Trichloroethylene

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(Received October 22, 1968)

Acrylonitrile (A) has been copolymerized with trichloroethylene (B) using benzoyl peroxide as initiator at 75°C. The reactivity ratios found by the method of Mayo and Lewis are \(r_A=62.1\pm3.5\) and \(r_B=0.0\). The theoretical curve obtained by using these values of reactivity ratios fits well to the experimental results. The determination of the mol wt and the chlorine analysis of the polymer indicate that the reaction product is a copolymer, not a telomer. Kinetic analysis has shown that at the initial stages of the reaction the time rate of acrylonitrile entering the copolymer is enormously faster than that of trichloroethylene whereas at the later stages when most of the acrylonitrile monomer is consumed both the time rates become comparable to each other. Further, evidence has been found that trichloroethylene homopolymerizes in the presence of benzoyl peroxide initiator at 75°C.

Introduction

Free radical induced binary copolymerizations of acrylonitrile and a number of other monomers have already been reported. Mention has been made of the reactivity ratios in the copolymerization of acrylonitrile (A) and trichloroethylene (B) at 60°C, but the experimental data on which the determination of the monomer reactivity ratios was based have not been published. In this paper the authors present the monomer reactivity ratios in the benzoyl peroxide initiated copolymerization of these two monomers at 75°C together with the rate of copolymerization as well as the homopolymerization of trichloroethylene initiated by the free radicals produced by benzoyl peroxide at 75°C.

Experimental

Material.—Acrylonitrile (B.D.H.) was dried over anhydrous sodium sulphate and distilled in an atmosphere of nitrogen. The middle fraction (b.p. 76.2°C, D,20°=0.806) was collected and stored at 0°C in the dark.

Trichloroethylene, (commercial grade) was distilled twice and the fraction boiling at 87°C was stored at 0°C in the absence of light. The density of the purified liquid was found to be 1.463 at 20°C.

Benzoyl peroxide (B.D.H.) was recrystallized twice from chloroform by the addition of methanol. The recrystallized product was dried under vacuum at room temperature and stored at 0°C in the dark.

Procedure.—All the copolymerizations were performed in sealed Pyrex tubes. A weighed amount of benzoyl peroxide (50 mg) was first poured through a funnel ending in a capillary into a Pyrex tube kept at 0°C. Then the required amounts of acrylonitrile and trichloroethylene were pipetted into the tube. The tube was flushed with nitrogen, carefully sealed and heated in a thermostat bath at 75.0 ± 0.1°C.

Analysis.—The copolymer was analysed for chlorine by burning a small quantity (40–50 mg) of it on a filter paper in oxygen (Schoniger combustion). The resulting gaseous product was absorbed in 10 ml of 0.1N sodium hydroxide solution containing 5 drops of 40% hydrogen peroxide. Finally, this solution was titrated for chlorine using Volhard's method. The accuracy of this method was checked by using the method of Carius. The deviation observed was within ±0.5%.

Kinetic Equations for the Determination of Reactivity Ratios.—In a binary copolymerization there are two kinds of active centres which form at the growing ends of the polymer chains. The behaviour of an active centre depends solely upon the terminal monomer unit, and is independent of the length or overall composition of the growing polymer radicals. If A and B are the two monomers and \(A^*\) and \(B^*\) represent the chains ending in A and B units, respectively, the four growth reactions, which occur in such a case, may be schematically represented by

\[
\begin{align*}
A^* + A & \rightarrow A_A^* \quad \text{(rate)} = k_{AA}[A_A^*][A] \quad (1a) \\
A^* + B & \rightarrow A_B^* \quad \text{(rate)} = k_{AB}[A_A^*][B] \quad (1b) \\
B^* + B & \rightarrow B_B^* \quad \text{(rate)} = k_{BB}[B_B^*][B] \quad (1c) \\
B^* + A & \rightarrow A_A^* \quad \text{(rate)} = k_{BA}[B_B^*][A] \quad (1d)
\end{align*}
\]
COPOlyMERIZATION

Part III.—Copolymerization of Acrylonitrile and Tetrachloroethylene

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(Received October 22, 1968)

A study has been made of the copolymerization of acrylonitrile and tetrachloroethylene in the presence of 1% (w/w) benzoyl peroxide at 50 and 75°C. The rate of copolymer formation is found to increase with the increase of acrylonitrile concentration. The increase in tetrachloroethylene concentration does not appreciably increase the incorporation of chlorine in the resulting copolymer. The monomer reactivity ratios at 75°C are \( r_1 = 456 \pm 70 \) and \( r_2 = 0 \). The mol wt determination of a copolymer sample has shown that the polymerization product is a copolymer not a telomer. The copolymer decomposes into insoluble black products between 200 and 218°C without showing any softening point.

Introduction

The copolymers of acrylonitrile are industrially very useful. The largest use of acrylonitrile is in the synthetic rubber industry where it is copolymerized with butadiene to obtain the well-known Buna-N and other nitrile rubbers. The materials made of nitrile rubbers are very durable because of their high tensile and impact strengths and high resistance to heat and many chemicals. In recent years the use of acrylonitrile in the synthetic fibre and plastic industries has grown enormously. The high nitrile content copolymers of acrylonitrile are useful materials for the production of fibres having good resistance to stretch, heat, microorganisms and insects. The nitrile containing plastics have excellent dielectric properties, light stability and high softening temperatures.

A knowledge of the usefulness of acrylonitrile copolymers had led us to study the unexplored copolymerization of this monomer with other monomers. The free radical or ionic polymerization of acrylonitrile monomer is so fast a reaction that the results at the initial stages of polymerization are irreproducible. Similar results have been observed by the workers of this Laboratory in the copolymerization of this monomer with a number of other monomers. Consequently, in most of the cases we have not reported the results of monomers conversion below 10%. The purpose of this work is to investigate the hitherto unreported kinetics of the copolymerization of acrylonitrile \((M_1)\) and tetrachloroethylene \((M_2)\) at 50 and 75°C and to study the properties of the copolymers formed. In addition, we have reported the monomer reactivity ratios in the copolymerization at 75°C. The monomer reactivity ratios in this system has already been reported by Doak from a single experiment at 60°C, who, however, failed to note the duration of the polymerization and the range of error involved in the determination of monomer reactivity ratios. Our results at 75°C do not differ much from Doak’s results at 60°C as expected but we have been able to point out the range of error involved in the determination of the monomer reactivity ratios in this copolymerization system.

Experimental

Materials.—Acrylonitrile (B.D.H.) was dried over Na₂SO₄ and distilled in an atmosphere of nitrogen. The middle fraction (b.p. 76.2°C) was collected and stored at 0°C in the dark.

Tetrachloroethylene (George and Becker) was fractionally distilled in an atmosphere of nitrogen and the middle third (b.p. 121°C, \( d_4^{15°} = 1.631 \)) was stored at 0°C in the dark.

Benzoyl peroxide (B.D.H.) was twice recrystallized from chloroform by the addition of methanol and dried under vacuum at the room temperature.

Both laboratory grade methanol (B.D.H.) and dimethyl formamide (B.D.H.) were used after distillation.

Procedure.—Required amounts of acrylonitrile, tetrachloroethylene and benzoyl peroxide were taken in Pyrex tubes. These tubes with their contents were cooled to 0°C while being flushed with nitrogen and then sealed carefully. Finally, the sealed tubes were heated at constant temperature in a thermostat bath. After the desired time of heating the tubes were cut open and the contents were individually washed with methanol and dried under vacuum at the room temperature to constant weight. In the calculation of all experimental data, the density of acrylonitrile and that of tetrachloroethylene were taken as...

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INTRODUCTION

Lane and his co-workers\textsuperscript{3} carried out the polarographic studies of coordination complexes of lead (II) ion with thiourea in aqueous solution at only 25°C, using 0.1 M potassium nitrate as supporting electrolyte and Triton-X-100 as maximum suppressor, while the concentration of thiourea was varied from 0.05 to 1 M. The above authors, applying the DeFord and Hume\textsuperscript{1} method to their practical data, proved the formation of four-coordinated species such as mono-, bis-, tris-, and tetrakis-, but the work of Federova\textsuperscript{3} indicated the existence of three species only. Consequently, the present work was undertaken to reinvestigate this matter of dispute as regards the number of coordination complexes.

EXPERIMENTAL

Materials.—Lead nitrate (E. Merck), potassium nitrate (E. Merck), thiourea (May & Baker), and Triton-X-100 (Rohm and Haas Co., Philadelphia) were used without further purification. The mercury was purified by passing through dilute nitric acid column, containing a little mercuric nitrate, and then by subsequent vacuum distillation. Nitrogen gas of 99.5% purity, supplied by Pakistan Oxygen Company, was further purified according to the method given by Hussain and Amjad.\textsuperscript{4} Stock solutions of 0.01 M lead nitrate, 1.0 M potassium nitrate, and 0.4% X-100 were prepared at frequent intervals.

Procedure.—For each run the required amounts of the stock solutions were taken in 100-ml measuring flask and diluted to a known volume. The concentration of lead nitrate (0.001 M), potassium nitrate (0.1 M), and Triton-X-100 (0.004%) were kept constant throughout the experimental work while the thiourea concentration was varied from 0.01 M to 1 M. Current voltage curves were obtained with a pen-recording Cambridge Polarograph. Dropping mercury electrode capillary characteristics at 25°C were, \(m = 0.3773 \text{ mg/sec,}\) and \(t = 6.028 \text{ sec/drop,}\) in 0.1 M \(\text{KNO}_3 + 0.001\text{M Pb(NO}_3)_2\) solution. Capillary constant, \(m^{3/6}\) was calculated to be 0.7047. The distance from capillary tip up to the mercury reservoir was 81.5 cm. The polarographic cell used during the experiments was of a type designed by Roe and Nyman.\textsuperscript{5} The saturated calomel electrode was prepared as described by Vogel.\textsuperscript{6} The same saturated calomel electrode was used throughout the experimental work. Agar-bridge, fresh for each experiment, containing agar-agar one molar with respect to potassium nitrate, was prepared. One arm of this bridge was dipped in saturated calomel electrode and the other in solution under investigation, in the designed cell.

The electrically operated thermostat, in which the saturated calomel electrode and cell containing the sample solution were placed, was controlled within \(\pm 0.1°C.\) The purified nitrogen gas was bubbled through the solution for 20 min. The gas was stopped while obtaining the polarogram.

RESULTS AND DISCUSSION

The diffusion currents \(i_d,\) (after correction for residual current) and the potentials corresponding to various values of current \(i,\) were obtained from the polarograms. The halfwave potentials were obtained by plotting the graphs of \((E_A - i)\) versus \(\log i/(i_d - i)\) as described by Meites.\textsuperscript{7} The zero intercept of such a plot gave the half wave potential of the corresponding curve. The half wave potential, the diffusion current and the DeFord and Hume functions, \(F_0(X), F_1(X), F_2(X), F_3(X),\) and \(F_4(X),\) at different concentrations of thiourea are given in Tables 1-3, at 10°, 25°, and 35°C, respectively, while the graphs between \(F(X)\) against the molar concentration \(X,\) of thiourea are given in Fig. 1. For the determination of formation constants the method of DeFord and Hume was used. The curved shape of each of the graph drawn by \(E_4\) versus \(\log X\) indicated
THE IR AND UV SPECTRA OF ALKYLTRIPHENYLARSONIUM COMPOUNDS

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(Received October 23, 1968)

The IR and UV spectra of the methyl, ethyl, n-propyl and n-butyl-triphenyl- and tetraphenyl, arsonium compounds have been recorded. The neighbouring group effect is noted from the variation in the intensity of the 1430 and 1000 band with the alkyl chain. The UV studies support the findings of the IR spectra and indicate dissymmetry in the molecules.

In a recent study on the phenylselenium1 and phenyl- and p-tolyolphosphonium compounds2 it was observed that a correlation of the structure of the compounds with the intensity of the various absorptions is possible. It was found that the lack of conjugation among the rings could also be deduced from the intensity of the bands in the 1600–1300 and 1300–950 cm⁻¹ and the splitting of the bands due to the C—H out-of-plane deformation in the 800–700 cm⁻¹ region. It is found that the shapes and the intensity of the bands in these regions have a characteristic pattern so that the previous generalizations regarding the orientation of the rings can safely be extended to the arsonium compounds. For the present study we have prepared a series of phenylarsonium iodides. It may be mentioned here that the spectra of the phenylarsonium compounds have appeared during recent years.3 4 Our results are in close agreement with the reported frequencies.

The spectra were recorded on freshly prepared compounds and the technique was the same as described earlier. The IR spectra were run on chloroform solutions as well as KBr pellets and nujol mulls. The bands in the 1600 to 1300 cm⁻¹ and 1300 to 950 cm⁻¹ region were recorded with chloroform solutions while those in the 900 to 650 cm⁻¹ region were recorded with KBr pellets and nujol mulls, and these are presented in Table 2 and depicted in Figs. 1–6. The UV spectra were recorded as reported earlier and are presented in Table 3.

**Experimental**

The methyl- and ethyl-triphenyl and tetraphenylarsonium iodides are already known. n-Propyl- and n-butyl-triphenyl arsonium iodide are new compounds. The arsonium compounds were prepared by conventional methods. The analysis and melting point of the compounds are reported in Table 1. The higher alkyl compounds are unstable and decompose easily on standing. The analytical results are therefore slightly in error.

<table>
<thead>
<tr>
<th>Compound</th>
<th>M.p.</th>
<th>Carbon %</th>
<th>Hydrogen %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Calc.</td>
<td>Found</td>
</tr>
<tr>
<td>Ph₃MeAs⁺I⁻</td>
<td>167</td>
<td>50.89</td>
<td>50.86</td>
</tr>
<tr>
<td>Ph₃EtAs⁺I⁻</td>
<td>148</td>
<td>51.95</td>
<td>51.43</td>
</tr>
<tr>
<td>Ph₃nPra⁺I⁻</td>
<td>135</td>
<td>53.94</td>
<td>53.42</td>
</tr>
<tr>
<td>Ph₃n-BuAs⁺I⁻</td>
<td>100</td>
<td>53.87</td>
<td>53.45</td>
</tr>
</tbody>
</table>

**Discussion**

It is noted that the spectra of the triphenylarsenic compounds are characteristic of the monosubstituted benzene and the absorptions due to the alkyl group in the arsonium compounds can be easily sorted out. The difference in the absorption pattern is seen to be in the intensity of the various bands, which has been shown to represent a change in the charge distribution in the ring.

The 1600–1300 cm⁻¹ Region.—The pattern of absorption in the triphenylarsine is quite similar to the isoelectronic triphenylselenonium chloride which suggests a similarity in the distribution of rings. The k and l modes in the case of triphenylarsine as well as the alkyltriphenylarsonium compounds are not resolved in the pellet or mull spectra but they do so in the solution. These bands are quite weak which suggests that the sub-
NONALKALOIDAL CONSTITUENTS OF BUXUS PAPILOSA

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(Received August 17, 1968; revised October 11, 1968)

Two new steroidal alcohols provisionally named and formulated as buxpapinol, C_{27}H_{46}O, m.p. 183–184°C, and buxpapininol, C_{27}H_{46}O_{2}, m.p. 248–251°C, have been isolated from the alcoholic extracts of Buxus papilosa.

Experimental

The shade-dried whole plant of Buxus papilosa (dry weight, 4 kg) was cut into small pieces and extracted with 95% ethyl alcohol (8 gallons) at room temperature. The alcoholic extract was concentrated under reduced pressure to a thick syrup. The syrupy residue was acidified with 5% acetic acid, kept in a refrigerator for 2 days and filtered. The acidic filtrate was saved for isolated alkaloids and the residue was worked up for its nonalkaloidal constituents.

The residue was treated with excess chloroform and the mixture was warmed and filtered. The chloroform-insoluble portion was dissolved in petroleum ether, charcoaled again and again, dried over anhydrous sodium sulphate and filtered, and concentrated under reduced pressure to give a brownish mass.

Isolation of Buxpapinol.—The brownish mass was refluxed with 10% alcoholic potassium hydroxide for 4 hr and the reddish brown solution was allowed to cool. Sufficient distilled water was added until a white curdy precipitate was obtained. This was extracted with chloroform, chloroform extract was charcoaled, dried over anhydrous sodium sulphate and solvent removed under reduced pressure to give a thick syrup which crystallized from methanol to give white crystals, m.p. 183–184°C. Repeated recrystallization did not raise its melting point. (Found: C, 84.08; H, 11.77; O, 4.16%. C_{27}H_{46}O requires: C, 84.0; H, 11.86; O, 4.14%).

The IR spectrum (Nujol) showed bands at 3390, 3012, 2941, 1639, 1460, 1372, 1075, and 1030 cm^{-1}. The NMR spectrum (CDCl_{3}) showed peaks at 9.4, 9.22, 9.16, 9.04, 8.7, 8.29 and 5.22 (singlet, probably CH—CH_{3}).

Acetylation of Buxpapinol.—Buxpapinol (1 g) was added to a solution of acetic anhydride (10 ml) and dry pyrine (10 ml). The mixture was refluxed for 4 hr cooled and poured on to crushed limestone, has already been found to contain a number of steroidal alkaloids. This paper describes the isolation and some of the properties of two new steroidal alcohols, provisionally named as buxpapinol and buxpapininol.

*Buxus papilosa* which grows gregariously on limestone, has already been found to contain a number of steroidal alkaloids. This paper describes the isolation and some of the properties of two new steroidal alcohols, provisionally named as buxpapinol and buxpapininol.

Buxpapinol, C_{27}H_{46}O, m.p. 183–84°C, gave positive tests for sterols. Its IR spectrum showed bands at 3390 (—OH), 1639 cm^{-1} (probably —C=C—), and 1075 cm^{-1} (probably secondary OH). The NMR spectrum showed complex peaks centred at 9.4 (probably cyclopropane protons), 9.22, 9.16 (probably a secondary methyl group), 9.04 (probably a tertiary methyl group), 8.7 (very strong peak, accounting for 6 protons), 8.54, 8.29 (probably methylenes of the steroidal nucleus), and 5.22 (one proton, probably, —CH—CH_{3}). Buxpapinol acetate showed IR bands at 1739 (very strong; C==O), 3390 (—OH), 1647 (C==C) and 1250 cm^{-1} (CO, ester); the nuclear magnetic resonance spectrum of the acetate showed identical peaks to those of free alcohol except for an additional peak at 7.94 (CH_{3}CO).

Buxpapininol, C_{27}H_{46}O_{2}, m.p. 248–251°C also gave positive tests for sterols. The IR spectrum showed bands at 3450 (—OH), 1625 cm^{-1} (C==O). The NMR spectrum showed peaks at 9.22, 9.15, 9.03 (accounting for 9 protons, probably a secondary and two tertiary methyl groups), 8.74, 8.60, 8.31 (complex peaks, probably methylenes of steroidal nucleus) and 5.23 (one proton, probably CH—CH_{3}). Buxpapininol acetate showed IR bands at 1739 (very strong, C==O of ester), 1704 (shoulder), 1645 (—C==C—), 1250 cm^{-1} (very strong; C==O of ester), and NMR peaks at 9.15 (singlet, probably two tertiary methyl groups), 8.98 (doublet, J=3.4 c/s, probably a secondary methyl group), complex peaks between 8.72–8.31 (probably methylenes of the steroidal nucleus), 7.93 (singlet, probably, CH_{3}—CO), and 5.31 (one proton multiplet, probably CH—CH_{3}).

Work is in progress to study the structure of these new steroidal alcohols.
EFFECT OF HOST PLANT ON THE CHEMICAL COMPOSITION OF CUSCUTA REFLEXA ROXB

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Cuscuta reflexa Roxb. collected from Zizyphus jujuba, Clerodendron inerme, Citrus medica and Accacia arabica, has been investigated with a view to examining if its composition changes with the change in the host. Petroleum ether, diethyl ether, ethanol and water extractives of the parasite have been examined for their composition. No influence of the host plant has, so far, been found on the chemical built-up of this parasitic climber.

Introduction

Cuscuta reflexa Roxb. is a well-known leafless parasitic climber with long twining yellowish green stems and white sweet-scented flowers. It thrives on many trees and bushes, showing a marked preference for certain species, e.g. Zizyphus jujuba. Growing on various trees it is found throughout the country and has extensively been employed in Unani system of medicine for the treatment of a variety of ailments. This parasite has been studied by various workers and there are conflicting reports as regards its chemical composition. For example, Agrawal and Dutta reported the presence of a flavonoid pigment and p-sitosterol. Instead, the later workers reported the presence of a flavonoid pigment and p-sitosterol. Similarly, Agrawal investigated the pigments of the parasite and found that they contained amarbelin only. Working on the colouring matter again, Gopinath has reported that instead of amarbelin, it is constituted of kaempferol.

From the foregoing reports it was clear that although C. reflexa has been studied from time to time, in fact, no systematic investigation had been carried out. This was essential as no two previously reported observations agreed with each other. However, Subramanian and Nair have ascribed the parasite's compositional variations to the influence of the host plant. Their hypothesis is based on an analogous study by Srimathi and Sreenivassaya on Santalum album Lin.

The present work was thus undertaken with a view to studying the composition of C. reflexa Roxb. grown on botanically different species of host plants, viz., Zizyphus jujuba, Clerodendron inerme, Citrus medica and Accacia arabica. The parasite could be grown easily and could, therefore, be had free from any material of the host plant. The purity of the sample was, therefore, assured.

As a result of the present investigations it has, so far, been observed that the composition of C. reflexa Roxb. does not vary with the change of the host plant. Various extractives of the parasite growing on different hosts have been shown to be identical as a result of the chemical analyses. It is quite possible that the differences in the composition reported earlier might have arisen due to the foreign impurities imported from the host plant.

Experimental

All melting points were determined on a Kofler block and are uncorrected. Organic extracts were dried over anhydrous sodium sulphate.

Petroleum Ether Extract.—Fresh stems of C. reflexa (1300 g) from the hosts were dried identically, in shade at room temperature, and extracted with petroleum ether (40–60°) in a soxhlet extractor. After removing the solvent, a waxy mass (3.65 g) was obtained that was chromatographed on alumina and eluted in succession with petroleum ether, diethyl ether and chloroform. Solvents were removed from the eluates at room temperature under reduced pressure and the residues obtained were weighed and purified by crystallisation. These observations are recorded in Table I.

Petroleum ether soluble fraction proved to be a hydrocarbon (m.p. 61–62°) as it did not depress the m.p. of a synthetically prepared hydrocarbon from the Wurtz reaction of n-tridecyl bromide. The diethyl ether soluble fraction was also an hydrocarbon (m.p. 76–78°). The chloroform eluates were identified to be p-sitosterol by comparison with the IR spectrum of a standard sample (m.p. and mixed m.p. 139–140°). Its acetate also had an undepressed melting point with that of an authentic sample (m.p. 133°).

Diethyl Ether Extract.—C. reflexa Roxb. samples which had been freed of petroleum ether soluble components, were then subjected to soxhlet extraction with diethyl ether. After removing the solvent the residue in each case was triturated with diethyl ether and the insoluble portion left behind
Chemical Investigations of the Paeonia Emodi Tuber

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(Received December 30, 1968; revised January 11, 1969)

The tubers of Paeonia emodi have been shown to contain salicylaldehyde, a fixed oil, starch, sucrose, fructose, glucose, benzoic acid and an unidentified substance giving different coloration at different pH. β-Sitosterol is the major constituent of the non-saponifiable matter of the fixed oil, while the saponifiable portion contains unsaturated fatty acids of C_{16} and C_{18} series.

Introduction

Paeonia emodi (family Renunculaceae) is an erect herb and is commonly found in the upper Hazara District and the Malakand, Khyber and Kurram Agencies. The tubers of the herb are medicinally used as purgative and emetic. A study of chemical literature shows that, so far, the chemical composition of the tubers has remained unknown. Nevertheless, work has been reported on the composition of the tubers as shown in Chart I.

Investigations have now been carried out on P. emodi with reference to its chemical constituents and the present paper sums up studies that have so far been completed. Fresh tubers of the herb as collected from Naran, Kagan Valley and Hazara District were dried in shade and ground to a powder (20 mesh).

The fractionation scheme of this material and the yields of various compounds isolated from it are shown in Chart 1.

Experimental

Steam-distillation Products: Recovery of an Essential Oil.—The powder was subjected to steam-distillation in an all-glass apparatus. An essential oil, amounting to 0.15%, was obtained. (i) The oil gave characteristic smell of salicylaldehyde. The b.p. of both the oil as well as that of salicylaldehyde was 197°C. (ii) Both the oil as well as the known sample of the aldehyde gave an identical violet coloration with ferric chloride. (iii) With strong solution of sodium hydroxide both gave a similar yellow coloration. (iv) The oil gave a 2,4-dinitrophenylhydrazone, m.p. 248°C, which is identical to the hydrazone obtained from an authentic sample of salicylaldehyde and 2,4-dinitrophenylhydrazone. Mixed m.p. of both the hydrazones was also the same. It was, therefore, concluded that the oil was salicylaldehyde.

Petroleum Ether Extractive.—A new and fresh lot of the powder was extracted with petroleum ether 60–80°C in a Soxhlet apparatus. A fixed oil and an acid were separated from the extractive by means of partition in minimum quantities of cold petroleum ether. The acid was identified as benzoic acid through various tests which have been described elsewhere in the text.

The amount of the oil obtained from the drug was 0.51%. Some of the characteristics of the oil are as follows:

Refractive index, 1.4920 at 17.2°C; setting temperature, 13–10°C; specific gravity 0.943 at 27°C; tint, 21 red and 9.9 yellow units on the Lovibond tintometer; acid no. 61.1; iodine value, 107.54 (Wij's 1 hr); ester no. 27.28; maleic anhydride value, 89.66; hexabromide value 0.56%; unsaponifiable matter 3.6%.

The oil was saponified and resolved into the saponifiable and non-saponifiable fractions according to Hilditch. The fatty acids as recovered from the saponifiable fraction were esterified with diazomethane and the esters subjected to examination by gas chromatography using Griffen and George gas chromatograph Model-S18-762.

From the unsaponifiable matter a sterol was isolated and identified. The unsaponifiable matter was resolved into methanol soluble and insoluble portions.
PRODUCTION OF ELECTROLYTIC LEAD POWDER

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(Received March 21, 1968; revised September 29, 1968)

Lead powder has been prepared by electrodeposition from baths of different electrolytic media, e.g., NaCl-PbCl₂; NaCl-KCl-PbCl₂; CaCl₂-PbCl₂ using graphite electrodes and NaOH using lead as electrodes. The limit of the optimum operating variables studied for CaCl₂-PbCl₂ electrolyte were: temperature of bath 50-55°C, current density 5-6 amp/dm²; lead chloride 20 g/l, and pH 5-6.

Use of NaOH as electrolyte (160-180 g/l), lead electrodes at a current density of 5.5-6.2 amp/dm² with the addition of 10-30 ml/l NH₄OH (sp. gr., 0.88) produced an easily detachable spongy deposit at bath temperature 25-27°C.

Lead powder is one of the three low melting metal powders produced in large quantities. It is extensively used for alloying and as an additional agent for those parts or bearings which are required to possess high specific gravity. Large quantity of this powder was used as an ingredient in rounds for target practice. Substantial amount of this powder is also used as an alloying ingredient in nonferrous and ferrous bearings, and as lubricant (5-15% by weight) in the moulding of copper. It also serves as a protective coating on the surface of various metals. A concise account of the conditions necessary for the production of lead powder by electrolytic methods has been given by various workers. In the following investigation an attempt has been made to work out the optimum conditions for the production of pure lead powder using different electrodes, electrolytes, pH values and temperatures of the bath.

Experimental

Apparatus.—The experiments were carried out in a 1-l beaker surrounded by copper jacket and kept in another vessel containing water. The apparatus was heated at the bottom while tap water was kept circulating in the outer jacket to maintain a constant temperature. The distance between the electrodes was kept 4 cm throughout the experiments.

A two-step rectifier of 6-12 volts was used as the source of electrical energy. A rheostat and a voltmeter were used in the circuit to tapout desired amperages and voltages.

Electrolytes.—The electrolytes were prepared from chemically pure reagents. The pH of the bath was adjusted with chemically pure hydrochloric acid, nitric acid or sodium hydroxide.

Electrolysis.—The electrolytic cell was filled with the electrolyte and its pH adjusted to the required value. After adjusting the temperature the current was switched on and each experiment was run for 30 min. The current was, however, interrupted after 15 min to remove the deposit. The rate of the electric current passing through the cell, the temperature and the pH were recorded at regular intervals and adjusted when required. Stirring of the solution was done by means of compressed air.

The powder thus removed was collected in an evaporating dish containing water, washed by decantation until free of the electrolyte, filtered in a sintered glass crucible under vacuum and dried in CO₂ atmosphere in an oven at 50-60°C to obtain a dry, stable and unoxidised product. For a given set of experiments the same cathode was used after washing it with dil HNO₃. In some experiments the powder was found to cake slightly when removed from the oven which could be easily disintegrated by placing it between the sheets of paper and rubbing slightly.

Results and Discussion

The object of the present problem was to obtain the optimum conditions to get pure lead powder. Once the optimum conditions were achieved, it was not very difficult to maintain the same conditions throughout the process. The slight deviation from these conditions was equally compensated for while recording the readings. The particle size of the powder can be varied, if required, by employing different operating conditions. The data obtained from the influence of concentration of electrolyte, temperature and pH of the bath and current density on the current efficiency have been presented in Tables 1-5.

The spongy deposit was obtained by using NaCl-PbCl₂ or KCl-NaCl-PbCl₂ combination
SALINITY APPRAISAL IN SOME SOILS OF SUKKUR DISTRICT, WEST PAKISTAN*

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(Received December 3, 1968)

This paper deals with some characteristics of salt-affected soils of Sukkur District in West Pakistan. The electrical conductivity, saturation percentage, sodium adsorption ratio and exchangeable sodium percentage of some of these soils have been discussed.

Introduction

In West Pakistan the injudicious use of irrigation water in the field without having any suitable arrangement for drainage has ultimately caused a gigantic problem of salinity and waterlogging, which at present looks very difficult, if not impossible, to solve. The ground water table at the beginning of irrigation agriculture was at a depth far below the danger limit. Every year new water used to be added to the soil, but there was no provision for this water to be drained out. This water moved downward and started to accumulate year after year and caused the ground water table to come near the root zone of the growing plants. The main trouble is that this ground water table brings with it the soluble salts which can easily affect plant growth both directly and indirectly. Hausenbuiller et al. worked with ground water in some Punjab soils and determined the extent of sodium accumulation in the 0-6-in layer of soils in the field which had been irrigated for several years. Their work showed that because of irrigation with Punjab ground water there was accumulation of high amount of exchangeable Na⁺ in the soil and the amount of Na⁺ accumulation was highly correlated with the "residual Na₂CO₃" content of the irrigation water. Bower and Maasland also worked with the ground water in the Punjab and predicted the bad effect of using such water for irrigation for a long time.

Since the soluble salts present in the saline and sodic soils determine the properties of these soils, it is essential to find out the amount of soluble constituents, such as, sodium, calcium, magnesium, potassium, chlorides, bicarbonates, carbonates and sulphates to characterize these soils. A vast literature exists regarding the reclamation of saline and sodic soils in West Pakistan but very few works have been done purely to characterize these soils from pedogenic point of view. In this paper a number of chemical and physicochemical features of few soils from West Pakistan, which were affected by salts and do not grow any plant, have been discussed.

Material and Methods

Nine soil samples from the Ghulam Muhammad Barrage area in the Sukkur district of West Pakistan were collected for this study. All the soil samples were from the surface covering an area of 10 square miles. Soil Nos. 3, 4 and 5 did not grow any crop in living memory and were barren for a long time. Other soils were from fields which used to be cultivated in the past but at present have gone out of cultivation.

The parent materials of the soils were alluvia carried by the river Indus and deposited on the floodplain on the two sides of the river channel. The parent materials were deposited by the floodwaters probably during the recent time.

There is no mineralogical study of the soils in this area, but from the X-ray diffraction study of the present soils it seems that mica, quartz and felspars are the dominant minerals. In the clay fraction there is kaolinite, mica and a small amount of 2:1 expanding lattice secondary silicate. The mineralogy of the parent materials of the present soils probably depends on their provenance.

For most of the chemical analyses the methods described in the USDA handbook No. 60 (USSL Staff 1954) were used. Electrical conductivity and pH were determined from the saturation extract of the soils. Exchangeable sodium percentage (ESP) was determined by the method given by Bower and Hatcher. In calculating ESP of the soils the following formula was used:

\[
ESP = \frac{\text{Exch. Na}^+}{\text{CEC}} \times 100
\]

*This work was performed by the author as a special short-term research problem in the University of Hawaii when he was a Ph.D. student there during the years 1963 to 1967. The author is grateful to Dr. R.L. Fox of the University of Hawaii, Honolulu, Hawaii for his help in collecting the soil samples.
Aluminium is thought to be the third most abundant element in the Earth's crust and is found in considerable quantities in all soils. The distribution and abundance of aluminium in soils depend on the climatic conditions in which the soils are located. Under the humid tropical climates the concentration of aluminium is high near the surface, but in the soils of the colder climates the concentration of this element is higher in the subsoil zones.

The fate of aluminium in the final decomposition of primary aluminosilicates may be exhibited by adopting the convenient diagram prepared by Goldschmidt, in which the lithophile and amphoteric elements of invarient valency are entered as points of which the (r) is the ionic radius and (ζ) the ionic charge. Goldschmidt pointed out that the elements of intermediate potential, such as aluminium, form insoluble oxides and hydroxides on weathering.

In soils, therefore, aluminium occurs as oxides, hydroxides and hydrated oxides. Aluminium also occurs in lattices of different primary and secondary silicates. In Hawaii, where due to intense leaching of soils the bases are removed very easily, the aluminium minerals of wide range of stability develop. The high acidity, in the presence of active aluminium, has caused concern over the possibility that activity of aluminium might become harmful to sugarcane.

Recently, considerable attention is being given to soluble aluminium as a factor in the harmful effects of acid soils upon plant growth. It is held by some authors that the soil acid reacts with aluminium compounds present in the soil forming soluble aluminium salts and that the amount of soluble aluminium salts thus formed, rather than the degree of acidity, determines largely the toxicity to plant growth.

According to Magistad the amount of aluminium present in soil solution depends on at least two factors: firstly, the amount and kind of aluminium compounds present in the soil, and secondly, the reaction of the system. Magistad believed that when a neutral soil is treated with AlCl₃ the chief replacement is one of H⁺ for the exchangeable bases of the soil. The H⁺ in the soil reacts subsequently with salts to give free acid which dissociates Al(OH)₃ from the soil. McAuliffe et al. and Low have emphasized the conclusion of Paver et al. that acid clays are in reality H₂AlO₂ clays. The latter authors proposed a mechanism of reaction as follows:

$$H_3[\text{Soil}] + Al(OH)_3 \rightarrow Al[\text{Soil}] + 3H_2O.$$  

Ayres et al. made an attempt to determine the source of water-soluble aluminium in soils. He inserted some of his own data in the expression of solubility product of gibbsite as follows:

$$pH - \frac{1}{2}pAl = 14 - \frac{1}{2}pKSp \quad (1)$$

in which pH is that of the extract and the activity of aluminium is expressed in moles/l. With the more acid soils the same values for pK were obtained and aluminium values for activities were calculated from the following equation:

$$Al^{+++} = \frac{[\text{Total Al}]}{fAl(OH)^{2+}} \quad (2)$$
A STUDY OF MINERALS IN SOME HAWAIIAN SOIL COLLOIDS*

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(Received November 21, 1968)

This work deals with the mineral content in the clay fraction of a number of soils in the Tropics. Kaolinite is found to be the dominant mineral. The presence of pedogenic mica in high rainfall area is reported.

Introduction

A knowledge of minerals present in the colloidal fraction of a soil is very important in any study of pedogenesis. The secondary minerals in soils usually form at the expense of the primary minerals. During pedochemical weathering the primary minerals in the parent material is weathered to form new mineral species with possible losses of some constituents from soil profiles. The conditions under which the primary minerals weather and the kind and conditions of formation of weathering products are all of considerable importance in understanding the genesis of secondary minerals. Mineral analysis in the colloidal fraction of soils, therefore, can give valuable information regarding the environment in which they were formed, provided the original minerals present in the parent materials of the soils are known.

There are two categories of minerals that may be present in the colloidal fraction of any soil. In the first group come the minerals that are synthesised in the soil environment from the constituents released by the chemical decomposition of the primary minerals. In this group of minerals come the secondary silicate clays. When the coarse grained primary minerals are physically weathered, fine, resistant colloid-sized minerals develop. Their chemical composition is the same as those from which they have been formed but with respect to size of the mineral particle they fall within the colloidal fraction. The minerals in the latter category, however, have no genetic relationship with the environment in which they are found.

The Hawaiian islands which are situated in the middle of the Pacific Ocean lie under the influence of tropical climate. This place is, therefore, very suitable for the study of weathering phenomenon in the tropics. Since the rocks are of volcanic origin, there is hardly any contamination in the parent material of the soils. One can find out with considerable degree of certainty the nature of parent material at the start of weathering.

The objective of the present study was: (1) to find out the dominant clay minerals in some soils of Hawaii and throw some light on their synthesis, (2) to find out the distribution of pedogenic mica (illite) in the soils under study, and (3) to find out how the genesis of clay minerals in the soils are related to the amount and distribution of rainfall when the parent rock is the same.

Literature Review

Not all minerals respond to the action of weathering with equal speed. Depending on the resistance of the minerals towards the effect of weathering, several authors have suggested mineral stability series. The stability to weathering action of a mineral species is the function of a large number of factors such as hardness, cleavage, original cracks in the crystal, coefficient of expansion and solubility under a specific environment. Some other factors such as grain size and specific surface may also be important in some cases.

Depending on the frequency of occurrence of a number of mineral species in rocks of increasing age Pettijohn2 proposed a stability sequence of minerals. This sequence was actually a stability table in which the more stable minerals appeared first in the sequence and the degree of stability decreased from anatase to olivine. Later on some other authors also have proposed mineral stability series basing on different qualities of the minerals.3-5

Jackson and Sherman4 and Hseung and Jackson6 proposed a weathering sequence for clay-sized minerals consisting of thirteen stages. This includes mineral species that are normally recognised as secondary minerals formed during pedochemical weathering. According to this arrangement of minerals, the simpler the structure

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*This work was performed by the author at the United States Salinity Laboratory at Riverside, California, when he was on a special training there during the summer of 1966. The author is indebted to Dr. Saleem Ahmed, Agronomy Officer, ESSO Fertiliser Company in West Pakistan, for collecting the soil samples and sending them to the author.
SOYABEAN AND RAPESEED GROWN IN THE HYDERABAD REGION, WEST PAKISTAN

The Oil Content and its Quality in Different Varieties

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The oil contents and analytical constants of the oils of some promising varieties of soyabean and rapeseed grown in the Hyderabad Region, were determined. K-30 variety of soyabean and S-9 variety of rapeseed gave the highest oil percentage and the lowest acid values.

Soyabean (Glycine max) and rapeseed (Brassica campestris) are the most important oil seed crops which are largely grown for their food value and oil content. Soyabean is today the most important plant on the world market. It has recently been introduced in the Hyderabad Region. Many new varieties of the crop have been evolved. The crop has great potentialities in the southern zone of West Pakistan and is likely to find an attractive market in our country. Similarly, many new varieties of rapeseed including other oilseed crops have been evolved.

It is not known at present as to which varieties of soyabean and rapeseed are most promising in the Hyderabad Region, specially with regard to their oil contents and analytical constants of their oils. It is the purpose of the present investigations to throw light on such important aspects of the problem, as these will help in the selection of better quality varieties.

Experimental

Three promising varieties of soyabean, viz. K-16, K-30 and S.B.L. and three varieties of rapeseed viz. S-4, S-9 and Yellow Sarsoon selected for the recent study were obtained from the Agronomy and Oilseed Sections of the Institute during 1962-63 and 1963-64, respectively. The oil content of the seeds was determined by the usual soxhlet extraction method while the analytical constants of the oils were determined by the standard methods of analysis, given by the A.O.A. C.3 and Woodman. Each estimation was repeated six times to minimize the experimental error. The results obtained were also statistically analysed.

Results

The analytical data regarding moisture, oil content and quality of soyabean and rapeseed oils are presented in Tables 1 and 2 for both 1962-63 and 1963-64.

TABLE 1.—VARIETAL MEANS OF THE MOISTURE AND OIL CONTENTS IN SOYABEAN AND RAPESEED DURING 1962-63 AND 1963-64.

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Moisture %</th>
<th>Oil %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1962-63</td>
<td>1963-64</td>
</tr>
<tr>
<td>Soyabean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K-16</td>
<td>6.9</td>
<td>7.23</td>
</tr>
<tr>
<td>K-30</td>
<td>6.1</td>
<td>7.03</td>
</tr>
<tr>
<td>S.B.L.</td>
<td>6.6</td>
<td>7.59</td>
</tr>
<tr>
<td>Rapeseed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-4</td>
<td>5.5</td>
<td>6.4</td>
</tr>
<tr>
<td>S-9</td>
<td>5.7</td>
<td>6.9</td>
</tr>
<tr>
<td>Yellow Sarsoon</td>
<td>5.1</td>
<td>6.1</td>
</tr>
</tbody>
</table>

Conclusions

The most promising varieties of soyabean and rapeseed were used to determine the quantity and

Table 2.—VARIETAL MEANS OF THE ANALYTICAL CONSTANTS OF SOYABEAN AND RAPESEED OILS DURING 1962-63 AND 1963-64

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Refractive index at 25°C</th>
<th>Acid value</th>
<th>Saponification value</th>
<th>Iodine value</th>
<th>RM value</th>
<th>Polenske value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soyabean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K-16</td>
<td>1.4724 1.4722</td>
<td>2.23 1.75</td>
<td>193.1 193.5</td>
<td>131.0 133.5</td>
<td>0.55 0.61</td>
<td>0.26 0.28</td>
</tr>
<tr>
<td>K-30</td>
<td>1.4714 1.4714</td>
<td>1.80 1.46</td>
<td>165.9 190.6</td>
<td>130.0 131.0</td>
<td>0.62 0.68</td>
<td>0.30 0.32</td>
</tr>
<tr>
<td>S.B.L.</td>
<td>1.4735 1.4741</td>
<td>1.93 1.70</td>
<td>191.6 192.4</td>
<td>134.0 135.4</td>
<td>0.72 0.72</td>
<td>0.27 0.30</td>
</tr>
<tr>
<td>Rapeseed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-4</td>
<td>1.4706 1.4712</td>
<td>1.49 1.15</td>
<td>172.0 172.8</td>
<td>98.0 100.0</td>
<td>0.42 0.46</td>
<td>0.52 0.52</td>
</tr>
<tr>
<td>S-9</td>
<td>1.4710 1.4714</td>
<td>1.56 1.26</td>
<td>172.7 173.7</td>
<td>101.0 103.0</td>
<td>0.39 0.37</td>
<td>0.58 0.63</td>
</tr>
<tr>
<td>Yellow Sarsoon</td>
<td>1.4706 1.4707</td>
<td>1.56 1.26</td>
<td>172.7 173.7</td>
<td>96.0 97.0</td>
<td>0.39 0.44</td>
<td>0.62 0.68</td>
</tr>
</tbody>
</table>
JUTE RETTING BACTERIA FROM CERTAIN RETTING DITCHES OF EAST PAKISTAN

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(Received July 7, 1967; revised December 3, 1968)

The action of different aerobic and anaerobic bacteria on green jute was studied and only Clostridium tertium, Cl. lacunarium, Cl. lactoacetophilum, Cl. histolyticum, Bacillus coagulans, B. circulates, B. polymyxa, and B. megaterium retted jute. Their retting properties and physiological characters are described.

Introduction

Jute refers to two species of plant, Corchorus capsularis, and Corchorus olitorious as well as the fibre derived from them. Retting constitutes a very important part in jute fibre production and is commonly carried out in East Pakistan by steeping jute plants under water of ditches and rivers for about 15–20 days, during which enzymes of microorganisms, mostly bacteria, enter into the plant tissues, hydrolyse the pectin, cementing the fibre strands and release the fibre for mechanical separation.

Different workers isolated various retting microorganisms from vegetable fibres to identify them and to study their retting properties under controlled conditions. Kayser and Delavel1 isolated five aerobic bacteria which retted flax and hemp. Patel and Ghose2 isolated some and rod shaped bacteria which retted jute. Debsarme3 isolated seven species of rod bacteria of which only Bacillus subtilis, B. macerans, B. macerans could ret jute. Ali4 studied Bacillus polymyxa, B. subtilis, B. pumilus, B. lentus and B. sphaericus of which only Bacillus polymyxa retted jute. Ahmad5 isolated some spore forming and non-spore forming bacteria which were B. brevis, B. alvei, B. sphaericus B. laterosporus, B. macerans, B. polymyxa, B. subtilis, B. megaterium, B. cereus, Micrococcus varians, M. lutus var. liquefaciens, M. corchorus and claimed them as active jute retters. Jalaluddin6 reported B. macerans, B. subtilis, B. cereus, and Bacillus megaterium as retters.

It appears that the retting organisms are plentiful and of various nature. With further studies it is likely that more effective and useful retting bacteria might be isolated, which might have some prospect of utilization in natural retting condition. This investigation was therefore undertaken to isolate more jute retting bacteria from certain retting ditches of East Pakistan and to study their characteristics in vitro.

Materials and Method

For the isolation of retting bacteria samples of retting water and retted fibre were collected from retting ditches from the districts of Bogra, Rangpur, Dacca and Mymensingh of East Pakistan. Small pieces of fibre from the retting jute plants together with some of the retting water squeezed from the fibre were taken in sterilized 250 ml conical flasks and immediately plugged maintaining strict aseptic condition. From these samples bacteria were isolated both aerobically and anaerobically. A small piece of fibre and 1 ml retting liquor from each of the sample were transferred to peptone yeast extract broth, PY, (peptone 5g, yeast extract 5g, dist. water 1000 ml). For anaerobic culture, when sufficient growth was observed in PY broth, the cultures were heated in water-bath for 20 min at 80°C to limit the study to spore-forming anaerobes only, and then plated out on nutrient agar by using a diluted culture (1 in 104). Representative colonies appearing after 7-day incubation were transferred to nutrient broth. Unless stated otherwise all cultures of anaerobic organisms were incubated at 37°C in specially made anaerobic jars (BTL anaerobic jar). For aerobic culture, PY broth cultures of all the samples were directly plated without prior heating and incubated at 37°C in presence of air. For testing the retting ability of the bacteria, autoclaved sterile jute stem pieces in test tubes in distilled water were inoculated with the bacteria and incubated at 37°C. A bacterium was taken as retter if it could completely separate the fibre of the jute stem in the test tube in 10 days.

Physiological and morphological characters of these bacteria were studied to key out the bacteria using Bergey’s Manual of Determinative Bacteriology (7th edition). Any variation from the characters of these bacteria as reported in the manual were recorded.

Result

Of the 256 different spore-forming bacteria isolated only eight of them retted jute at 37°C.
Porphyrins are the biosynthetic precursors of haem, the prosthetic group of haemoproteins, and chlorophyll. These derivatives of porphyrin function primarily in energy metabolism, as carriers of O₂ (the haemoglobins) as electron carriers (the cytochromes), as agents for trapping radiant energy (the chlorophylls). All forms of life, with the exception of obligate anaerobes and lactobacilli, which obtain energy by fermentation, therefore, depend upon their ability to synthesize these derivatives. The biosyntheses of the prosthetic group of different haemoproteins share a common pathway as far as porphyrins from 8-aminolaevulic acid (8-AL) from succinate and glycine, which are part of the basic metabolic milieu. Two molecules of 8-AL condense to form the 5-membered pyrrole ring, porphobilinogen (PBG). Four molecules of PBG then condense to form the first cyclic tetrapyrrole, uroporphyrinogen (isomer I1), with side chains of 4 acetic and 4 propionic acids. The ACIDIC acid side chains of the reduced porphyrin are then successively decarboxylated to coproporphyrinogen (coproporphyrin when oxidized). Two of the propionic acid groups are oxidatively decarboxylated to form propoporphyrinogen. Propoporphyrin is formed on oxidation and Fe²⁺ incorporated into it to yield haem. The enzymes catalyzing the various steps of the pathway have been detected in preparations from various sources and have been subjects of detailed study. Requirement for some metals by the cell suspension of Micrococcus colpogenes was studied. Fe²⁺ had maximum stimulatory effect, with 90% increase in synthesis, and was followed by Ca²⁺ (73.5% increase) and Mg²⁺ (60.7% increase). Cu²⁺ was quite inhibitory and reduced the activity of the cells to only about 10%. The effect of different cations was different on different enzymes of the pathway. Formation of coproporphyrin was greatly increased in the presence of both Fe²⁺ and Ca²⁺ but most protoporphyrin accumulated only in the presence of Fe²⁺. Cu²⁺ was inhibitory, particularly, for the enzymes catalyzing the synthesis of uroporphyrin from 8-aminolaevulic acid.

The effect of four divalent cations on the synthesis of porphyrins from 8-aminolaevulic acid by cell suspension of Micrococcus colpogenes was studied. Fe²⁺ had maximum stimulatory effect, with 90% increase in synthesis, and was followed by Ca²⁺ (73.5% increase) and Mg²⁺ (60.7% increase). Cu²⁺ was quite inhibitory and reduced the activity of the cells to only about 10%. The effect of different cations was different on different enzymes of the pathway. Formation of coproporphyrin was greatly increased in the presence of both Fe²⁺ and Ca²⁺ but most protoporphyrin accumulated only in the presence of Fe²⁺. Cu²⁺ was inhibitory, particularly, for the enzymes catalyzing the synthesis of uroporphyrin from 8-aminolaevulic acid.

Experimental

Reagents.—Hydrochloric acid, Analar (BDH); ethylacetate, peroxide-free; diethyl ether, peroxide-free; cyclohexane; acetic acid; pyridine, all lab. grade chemicals (May & Baker); 8-aminolaevulic acid, Al hydrochloride (Sigma Chemical Co., U.S.A.); Uroporphyrin I and III (free acid compound), prepared by hydrolysis of corresponding uroporphyrin octamethyl esters (L. Light & Co., Ltd., Colnbrook); coproporphyrin I and III (free acid compound) prepared by hydrolysis of corresponding coproporphyrin tetramethyl esters (Sigma Chemical Co., U.S.A.); propoporphyrin IX (free acid compound), prepared by hydrolysis of propoporphyrin IX diethyl ester (Eluka, A.G. Chemische, Fabrik Bucha S.G., Switzerland).

Methods

Organism and Conditions of Culture and Harvesting.—A strain of Micrococcus colpogenes, isolated locally, was used in the study. The organism was grown with rotatory agitation for about 18 hr at 30°C in a medium composed of peptone (1%, w/v), yeast extract (0.1% w/v) and NaCl (0.5%, w/v), adjusted to pH 7.5. Cells were harvested by centrifugation at 4°C and were washed twice with distilled water and once with 0.05M potassium phosphate buffer, pH 7.5. Washed cells were suspended in 0.1 M potassium phosphate buffer, pH 7.5.

Incubation of Cell Suspension with 8-AL.—Reaction mixtures (see below) were incubated aerobically...
NUTRITIONAL REQUIREMENTS OF STREPTOMYCES ROSEOCHROMOGENES FOR CYCLOSERINE PRODUCTION

Part I.—Effect of Carbon and Nitrogen Sources

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(Received July 15, 1968; revised November 20, 1968)

The biosynthesis of cycloserine by different species of Streptomyces was studied. Streptomyces roseochromogenes produced maximum amount of cycloserine. Organic nitrogen sources such as urea or peptone gave better results of cycloserine production than inorganic nitrogen sources. Of the six carbon sources, starch was most suitable for optimum yield of antibiotic.

Introduction

Cycloserine is a broad spectrum antibiotic active against both Gram positive and Gram negative bacteria including mycobacteria such as Mycobacterium ranae. It has been found particularly effective in the treatment of tuberculosis and urinary tract infections in man.1,2 It is also used for certain other bacterial infections and leprosy.3 The antibiotic is produced by the microorganisms of the genus Streptomyces such as S. orchidaceus,4-6 S. garyphalus,7 S. lavendulae,8-10 S. roseochromogenes11,12 and S. nagasakiensis13 and the work has mostly been reported in patents. The present paper describes the selection of Streptomyces strains and their nutritional requirements for the production of cycloserine in shake flasks as a preliminary to pilot plant studies.

Material and Methods

Organism.—The following strains of the genus Streptomyces were used: S. lavendulae IMI39045, IMI39046 and UGOC (University of Guelph, Ontario, Canada); S. roseochromogenes IFO3363, IFO3411, NRRL-B2036 and NRRL-B1230.

Media.—The composition of the media used in the present work are given in Table 1. All reagents were of analytical grade. Glass-distilled water was used for the preparation of solutions. All media unless otherwise stated were autoclaved at 121°C for 15 min. The pH value of the medium was 6.8.

Inoculum Preparation.—All cultures were maintained on sporulation medium incubating at 30°C for 10 days. Vegetative inoculum was used in the present study. 25 ml inoculum medium in 300 ml shake flasks was inoculated with a loop of mycelium from the agar slant. It was incubated at 30°C for 48 hr.

Shake Flask Cultures.—For shake flask culture, 25 ml fermentation medium including 1 ml vegetative inoculum was held in a 300 ml conical flask shaken on a rotary shaker (throw 14 in) and rotated at 125 rev/min.

Analytical Method.—Cycloserine was estimated colorimetrically by the method of Jones. The growth of Mycobacterium tuberculosis was inhibited by the cycloserine produced by all the strains.

Results

Selection of Strain.—Three strains of S. lavendulae and four of S. roseochromogenes were examined for cycloserine production. The amount of cycloserine produced 86 hr (peak yield; see Fig. 1) after inoculation, are shown in Table 2. The comparison of cycloserine production was carried out in the presence of different sources of nitrogen such as peptone and urea. Streptomyces lavendulae UGOC and S. roseochromogenes NRRL-B2036 produced cycloserine in both media. The latter gave better yield of cycloserine in the medium containing urea and peptone. For further studies, therefore, S. roseochromogenes NRRL-B2036 was used.

Effect of Nitrogen Source on Cycloserine Production.—Twelve sources of nitrogen were examined for their effects on the production of cycloserine by S. roseochromogenes NRRL-B2036. The results obtained 86 hr after inoculation are given in Table 3. The concentration of each nitrogen source corresponds to the nitrogen level of 0.22%. Nitrogen sources of organic nature, in general, gave better yields of cycloserine than those of inorganic sources. The production of cycloserine was maximum in the presence of urea (2.4 g/l), and peptone (1.95 g/l), at 86 hr.

Effect of Nitrogen Concentration.—Fig. 2 shows the effect of nitrogen concentration on the biosynthesis of cycloserine.
COPROPHILOUS FUNGI OF WEST PAKISTAN

Part III. Karachi

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(Received October 16, 1968)

In continuation of the studies of coprophilous fungi from West Pakistan, eleven more species have been reported. Ten of them belong to Ascomycota and one to Myxomycota. These consist of Ascobolus leveillei Boud., A. stercorarius (Bull.) Schrot., Ascomanus ochraceus (Crouan) Boud., Chaetomium caprinum Bainier, C. funiculum Cooke, Delitschia vulgaris Griff., Podospora inflata Cain, Sporormiella minima (Ayersw.) Ahmed and Cain, Sp. pseudominima Ahmed and Cain, Sp. tetramera Ahmed and Cain, and Licea tenera Jahn.

All these species have been recorded for the first time from Karachi. Ascobolus leveillei, Chaetomium caprinum, Delitschia vulgaris, Podospora inflata, Sporormiella pseudominima, Sp. tetramera and Licea tenera have never been reported from West Pakistan.

Brief descriptions which could help laboratory identifications have been provided.

Introduction

In our first paper7 of this series, the genera Delitschia and Trichodelitschia were reported for the first time from West Pakistan. The species reported for the first time were: Ascobolus subglobosus Seaver, Ascophanus argenteus (Curr.) Boud., Sacco-

bolus violascens Boud., Delitschia marchelii Berl. and Vogl., Sporormia fimetaria De not., Trichodelitschia bispurula (Cr.) Lundqvist, and Zygozophasia zygospora Boedijn. In the second paper8 of this series, the genus Lophiotrichus was reported for the first time from West Pakistan. The species new for this region were: Ascophanus aurora (Crouan) Boud., A. lacteus (Cooke and Phill.) Sacc., Chaetomium aterrimum Ell. and Ev., Lophiotrichus brevirostratus Ames, and Thieliadia variopinosa Cain. All of the eleven species included in the present paper have never been recorded from Karachi. The species recorded for the first time from West Pakistan are: Ascobolus leveillei Boud., Chaetomium caprinum Bainier, C. funiculum Cooke, Delitschia vulgaris Griff., Podospora inflata Cain, Sporormiella pseudominima Ahmed and Cain, Sp., tetramera Ahmed and Cain, and Licea tenera Jahn.

Materials and Methods

During the examination of the specimens quoted in this paper, camera lucida drawings were made and short notes taken. These were used respectively for illustrations and descriptions of the individual species.

The collections examined during the present studies are deposited in the Mycological Herbarium of the P.C.S.I.R. Laboratories, Karachi. The numbers of these specimens are quoted at the end of each of the species described. For any additional information about the materials and methods, our previous papers7,8 of this series may be consulted.


Ascobolus Boudieri Quel., Ench. Fung. 293, 1886.


Ascobolus leveillei, Chaetomium caprinum, Delitschia vulgaris, Podospora inflata, Sporormiella pseudominima, Sp., tetramera and Licea tenera have never been re-

ported from West Pakistan.

Materials and Methods

During the examination of the specimens quoted in this paper, camera lucida drawings were made and short notes taken. These were used respectively for illustrations and descriptions of the individual species.

The collections examined during the present studies are deposited in the Mycological Herbarium of the P.C.S.I.R. Laboratories, Karachi. The numbers of these specimens are quoted at the end of each of the species described. For any additional information about the materials and methods, our previous papers7,8 of this series may be consulted.


Ascobolus Boudieri Quel., Ench. Fung. 293, 1886.


The size range of some of the structures, like the ascocarps and the spores of our specimen has been found slightly smaller. Since the measurements fall within the prescribed limits of A. leveillei, it is considered to be the same (Plate I, A-Alj.


Peziza stercoraria Bull. Herb. Fr. Pl. 376, f.l. 1787.

CHEMICAL CONTROL OF RICE BLAST CAUSED BY PIRICULARIA ORYZAE CAV

Part I.—Effect of Several Foliar Fungicides on P. Oryzae in Vitro

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(Received October 25, 1968)

The relative merits of several fungicides potentially effective against foliar diseases were evaluated in the laboratory for their effectiveness against Piricularia oryzae. All fungicides tested inhibited spore germination when used at a concentration of 200 ppm, but only four products were effective at 100 ppm or less: Blasticidin-S (an antibiotic from Streptomyces griseorhodormae Fukunaga), PMA (phenyl mercuric acetate), Actidione (cycloheximide) and Du-Ter W-50 (triphenyl tin hydroxide). Similarly, only these 4 materials were highly effective on the growth of P. oryzae and retarded mycelial growth at concentration as low as 50 ppm. Because of its selectivity, the growth-inhibition test is preferable to the spore-germination test as a primary means of selecting potential rice blast fungicides.

Introduction

Blast, caused by Piricularia oryzae Cav., is an internationally important disease of rice. In many countries it seriously reduces rice production.1-3 Blast is characterized by brown lesions on the leaves and on the neck (top node of the panicle). Both of these phases can be highly destructive.4 Severe leaf infection leads to total destruction of the foliage (Fig. 1). As a result of the neck infection, half filled or totally chaffy panicles are formed and the heads also tend to break over at the point of infection. The disease is known by a number of common names: rotten-neck, leaf blast, node blast, brusone, momi-imochi and many others.5 The early records of rice blast were mainly from Italy and Japan. P. oryzae was first described in 1891 by Cavara in Italy.

Control of blast by means of resistant varieties is the most economical control method, but the task of replacing the present susceptible types with resistant ones is, in most cases, laborious and time consuming. Besides, the possible occurrence of new or more virulent pathogenic races of P. oryzae challenges the available sources of resistant germ plasm and may nullify prior breeding work. In addition, the blast pathogen has many pathogenic races which complicates breeding work. Frequently, however, susceptible varieties are grown when resistant varieties are unavailable or when certain qualities of rice are desired. These varieties can undergo even greater yield losses from rice blast when they are heavily fertilized, particularly with nitrogenous fertilizers.6-7 Some of the more serious losses may be reduced by proper chemical control. The primary objective of the present investigation was to explore the possibility of chemical control of rice blast. Several fungicides potentially effective against foliar diseases were selected. The relative merits of these materials, based on their ability to retard mycelial growth and spore germination of P. oryzae, were evaluated in the laboratory.

The germination of fungus spores in presence of chemicals is an important method for determining the fungistatic action of the materials and is recommended by the American Phytopathological Society.8 Many investigators have used spore-germination tests for initial screening of fungicides against various pathogens. Terui
CHEMICAL CONTROL OF RICE BLAST CAUSED BY PIRICULARIA ORYZAE CAV

Part II.—Fungicidal Effect of Selected Fungicides Against Rice Blast in-Vivo

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The performance of several foliar fungicides against rice blast was determined under greenhouse and field conditions. Because of the varying degrees of phytotoxicity observed, the maximum concentration of each of the candidate fungicides causing little or no phytotoxicity was determined. Actidione was phytotoxic even at a rate as low as 25 ppm. PMA caused slight injury at 75 ppm and was very injurious at 150 ppm. Du-Ter W-50 was slightly phytotoxic at 250 ppm and injurious at 500 ppm. Blasticidin-S was essentially nontoxic at 40 ppm. Phytotoxicity was enhanced when the treated plants were held in a humidity chamber. Blasticidin-S, Du-Ter W-50 and PMA were all protectants and significantly controlled leaf blast. In field trials, Blasticidin-S, PMA and Du-Ter W-50 reduced neck infection. In a moderate blast epiphytotic, the yield was significantly increased by these fungicides. In general, two-spray applications were better than one. A single application of Blasticidin-S was more effective than two spray applications. An interval of 6 days between first and second applications was found to be a realistic time interval for application of fungicides. Mild outbreaks of blast are related to fewer conidia in the atmosphere and no striking build-up of conidia developed through the susceptible stages of plant growth.

Introduction

The evaluation of chemicals in the greenhouse for the control of plant disease is an important intermediate step in the development of a new fungicide. The in vitro laboratory test usually determines which chemicals tested are sufficiently lethal or inhibitory to certain plant pathogens to warrant further study with them. In an earlier communication the results of laboratory evaluation of 20 potentially effective foliar fungicides against Piricularia oryzae were discussed. Certain fungicides which are less effective in vitro can control disease in vivo. In view of this, 14 of the 16 chemicals were included for comparative study in vivo conditions in 1965. Two new experimental chemicals, Fungicide 1991 and EL-33 of the 4 materials, received later, were included in the experiments of 1967.

In the disease control programme it is necessary to use the maximum concentration of the chemicals having little or no toxicity in order to give the maximum protection to the plant against the pathogen. In the laboratory tests some chemicals may be found effective against a pathogen at a higher concentration while others may be similarly effective at lower concentrations. Further, the chemicals which are effective at low concentrations may be highly phytotoxic. In these situations it may be necessary to use less effective but less phytotoxic chemicals. So greenhouse experiments were designed to determine: (1) whether the test fungicides were phytotoxic and to use these data to establish dosages for subsequent greenhouse and field experiments (2) whether the fungicidal activity, as determined in the laboratory, is related to disease control in the greenhouse.

Acceptance of fungicides for commercial use depends on field performance. Therefore, a portion of this study was designed to determine the relative performance of the test fungicides under field conditions.

The effective and efficient control of plant diseases depends upon the ability to anticipate their outbreak. The forecasting of rice blast in Japan is based on (a) over-wintering of the fungus, (b) variety of rice, (c) conidial production, (d) time of appearance and prevalence of conidia in the field, and (e) weather in relation to development of rice plants. In consideration of an eventual need for forecasting, an experiment was designed to estimate the spore population of the experimental area.

Literature Review

Every year several hundred new fungicides are prepared and are evaluated in the greenhouse against various diseases for their effectiveness as a surface protectant, but only limited greenhouse tests have been made using P. oryzae. In Japan
A key is proposed to identify the species of *Fusarium* taking into account the modifications of Wollenweber’s classification made by Snyder and Hansen.

**Key**

1. Microconidia generally aseptate and different from macroconidia 7

2. Growth is slow (with feeble aerial mycelial growth). Many of them grow on other fungi and insects
   - *Fusarium ciliatum* (L.K.) Snyder and Hansen
     (Wollenweber’s group *Pseudomicrocera* and *Submicrocera*)
   - or
   - *Fusarium episphaeria* (Tode) Snyder and Hansen
     (Wollenweber’s group *Eupionnotes* and *Arthrosporiella*)

3. Macroconidia mostly without pedicel
   - *Fusarium nivale* (Fr.) Snyder and Hansen
     (Wollenweber’s group *Arachnites*)

4. Chlamydospore present. It may be intercalary or terminal. Macroconidia may be spindle-shaped or broadend. Base some times with parabolic or hyperbolic curvature
   - *Fusarium roseum* (Lk.) Snyder and Hansen
     (Wollenweber’s groups *Gibossum* and *Arthrosporiella* and part of *Discolor*)

5. Macroconidia cylindrical in the middle, thin-walled and constricted at the tip

6. Macroconidia with both ends unequally curved and gradually tapering, often thread-like and almost cylindrical in the middle
   - *Fusarium roseum* (Lk.) Snyder and Hansen
     (Wollenweber’s group *Roseum*)

7. Macroconidia with both ends similarly curved and generally constricted at the tip. Almost cylindrical at the middle
   - *Fusarium lateritium* (Nees.) Snyder and Hansen
     (Wollenweber’s group *Lateritium*)

8. Microconidia not pear shaped
A NEW GENUS AND TWO NEW SPECIES OF NIRVANINAE (CICADELLIDAE—HOMOPTERA) FROM PAKISTAN

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(Received October 30, 1968)

The subfamily Nirvaninae has not been so far reported from Pakistan. The Indian species of the subfamily are poorly described and with uncertain relationships. The genus *Quercinirvana*, n. gen. has been recorded from both East and West Pakistan. Presently two new species (*Q. longicephala*, n. sp. and *Q. bengalensis*, n. sp.) of the genus have been described. The genus appears close to the genera *Nirvana* kirkaldy and *Kana* Distant.

The leafhopper subfamily Nirvaninae was first recognised as a separate group of leafhoppers by Baker in 1923, and characterized by Kramer, Evans, Matsumura and Ishihara. They have their form somewhat depressed, crown extended anteriorly, produced much beyond the eyes, and ocelli on crown in front of the eyes. The subfamily is mostly distributed in the Old World, with a great diversity of its genera and species, a majority of which require revisionary studies.

The Indian fauna of Nirvaninae has been described by Distant under the subfamily Jassinae. The species have been poorly described as is the case with other leafhoppers of Cicadellidae. Evans recognised 10 genera of Indo-Ceylonese Nirvaninae. The taxonomic position of these genera can however be regarded only tentative until a revision of Indian genera is made. None of these genera has been reported from the territories now included in East and West Pakistan.

The following description of *Quercinirvana*, n. gen. is based on the material collected from East and West Pakistan and appears quite close to *Nirvana* Kirkaldy and *Kana* Distant in venational characters, and head structure.

**Genus Quercinirvana**, n. gen.

Type of the genus, *Quercinirvana longicephala*, n. sp.

**Hindwings.**—Vein 1V branching from vein 2V proximad to midpoint; posterior branch of 'R' not fused with vein M+1; vein Cu4 appearing branched apically; submarginal vein extending around wing apex and confluent with extremity of posterior branch of vein 'R'; vein Cu4 confluent with submarginal vein opposite vein m-cu.

**Forewings.**—Appendix present, extending around wing apex, or only up to the first apical cell; first apical cell twice as long as second; fourth apical cell triangular or quadrilateral; one antepical cell present on costal margin.

**Male Genitalia.**—Male plate longer than pygofer, in ventral aspect with macrosetae spread in distal half, with numerous microsetae along lateral margin and at apex; pygofer with rounded posterior margin, with a group or groups of marginal or discal macrosetae, with a stout ventral process; style with a preapical lobe, apical extension conical, or tapered, directed laterad, or postero-dorsad; connective Y-shaped, with arms much divergent, stem shorter or longer than style; aedeagal shaft tubular, curved dorsad, with processes arising variously; dorsal apodeme generally well developed; preatrium usually reduced.

On the basis of external morphological characters as well as wing venation, the genus appears close to genera *Nirvana* Kirkaldy and *Kana* Distant, reported from Ceylon and Southern India. The type species of the genus *Nirvana* is not traceable, (Distant 1908: 282) nor it has been figured by the author. Venational characters of other species of the genus, e.g. *N. pallida* Melichar as illustrated by Matsumura show a marked difference from *Quercinirvana*, n. gen., which has an appendix in forewing and the submarginal vein in hindwing confluent with vein 'R'. While in *N. pallida* the appendix in forewing is absent, and the submarginal vein is extending beyond the vein 'R'. The head in the case of *Kana* Distant has crown slightly longer than wide, whereas it is much longer than wide in *Quercinirvana*, n. gen. None of the species of the two genera *Nirvana* and *Kana* has been properly described so as to allow a more reliable comparison, nor any other genus can be placed in the subfamily Nirvaninae from Indo-Pakistan with much certainty. *Quercinirvana*, n. gen. appears also close to the Western genera *Neoirvana* Oman, and *Kroczzolata* Kramer, but differs in having stout connective, and aedeagus with varied development of processes. The type species of the genus *Kroczzolata* Kramer is however based on a female, and its true characteristics would be
HISTOCHEMICAL STUDIES OF PHOSPHOMONOESTERASES IN DIFFERENT TISSUES OF DESERT LOCUST, SCHISTOCERCA GREGARIA (FORSKAL)

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Acid and alkaline phosphatases were demonstrated histochemically in various tissues of the desert locust using naphthol AS-phosphates as substrates. Sharp localization of phosphatase activity as insoluble red (acid phosphatase) or blue (alkaline phosphatase) chromogens resulted. Distinct acid phosphatase activity was localized in neurons while moderate alkaline phosphatase activity was mostly localized in the neuropile mass of the brain.

The cuticle was devoid of both of these enzymes. The cardiac muscles showed weak acid and no alkaline phosphatase activity. The pericardial cells were positive for acid phosphatase and negative for alkaline phosphatase. Haemocytes and haemolymph showed no phosphatase activity.

The tracheal and muscular systems were devoid of both enzymes. Some of lobes of the adipose tissue showed weak acid and faint alkaline phosphatase activity. The functional aspect of these organs has been correlated with the physiological distribution of the phosphatase enzymes.

Introduction

The histochemical localization of phosphomonoesterases in different tissues of insects was undertaken by many workers. Most of them localized these enzymes in holometabolous insects. Therefore, present work was undertaken to study these enzymes in a hemimetabolous insect and to correlate them with the most probable functions in different tissues. This study does not include digestive and reproductive systems, which have been dealt with separately.

Materials and Methods

(a) Rearing of Schistocerca gregaria (Forskal).—The locust were bred as described by Qureshi and Ashrafi with certain modifications over the technique described by Jones. The egg pods were incubated in an incubator running at 34°C and the nymphs of different instars were kept in different cages.

(b) Histochemical Techniques.—The histochemical studies were undertaken on sexually mature adult locusts starved for 48 hr. Immediately afterwards they were chilled for 40 min at a temperature of −10°C to avoid serious post-mortem distortion of phosphatases.

The dissections were done quickly in a dish containing equal volumes of alcohol and acetone, placed on crushed ice. This gave satisfactory results for the study of phosphatases. The slices (3 x 3 mm) of chilled tissues were placed in the fixative at −10°C for 24 hr.

Two baths of the fixative, after 8 hr interval were given for fixation and dehydration. The tissues were then washed twice for 15 min each in cold chloroform and were embedded in paraffin wax of 45-50°C melting point under reduced atmospheric pressure for 10-25 min, depending upon the thickness of the tissues. Sections cut at 9 microns were carried over microscopic slides and stretched over hot distilled water at 38-40°C. They were dewaxed in cold xylene for 30 min and transferred along with other slides to the incubation mixture held at the water bath temperature of 38°C from 30 min to 2 hr.

The blank slides were prepared by treating them with dilute nitric acid for 10 min, and then transferred along with other slides to the incubation mixture held at the water bath temperature of 38°C from 30 min to 2 hr.

(c) Incubation Mixture.—The incubation mixture was prepared as described in Sigma Technical Bulletin, No. 82 (anonymous). Naphthol-AS-MX(A) and Naphthol AS-MX(L) phosphates were used as substrates for acid and alkaline phosphatases respectively. They hydrolysed and yield naphthols which are readily coupled with diazonium Red Violet LB and Fast Blue RR Salts to form insoluble chromogenic precipitate, red for acid and blue for alkaline phosphatase.
FISHES OF THE ORDER SYNGNATHIFORMES

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(Received October 31, 1968).

Some fishes, belonging to the Order Syngnathiformes were collected from Pakistan waters. These were placed under families Aulostomidae, Fistularidae, Centriscidae and Syngnathidae. Since these are small and live usually in the sea weeds, few are caught by the fishermen. As food also these fishes are not considered good. Their habits are also briefly described.

These are less-known fishes owing to their habitat and as these are of no commercial importance, these are not even collected by fishermen. Of small size and generally escaping the net, excepting that some are caught occasionally in a trawl or small-meshed net when fishing in the weeds. These are generally characterised by their very small mouth which is situated at the end of a tube-like snout. Body is covered with minute scales or a protective bony sheath, or encased in stout bony rings. These are sluggish, slow-moving fishes, generally inhabiting the weeds where they conceal themselves.

This order is divided into two sub-orders which are stated below:

1. Mouth toothed. Body covered with scales, lateral line continuous, minute spines or naked. Sub-order Aulostomoidei.


Families of Sub-order Aulostomoidei:

(i) Body compressed, scaly. Dorsal fin divided into spinous and soft parts. Anus far behind pelvic fins. Family Aulostomatidae.

(ii) Body depressed, without scales. Short soft dorsal fin only. Anus close to pelvic fins. Family Fistularidae.

Families of Sub-order Syngnathoidei:

(i) Two dorsal fins. Trunk encased in cuirass or body plates. Family Centriscidae.

(ii) One or two dorsal fins, pelvic absent. Body completely encased in armour of bony rings. Family Syngnathidae.

Family Aulostomidae.

Fishes with pronounced tube-like snout with small mouth at the end. Body elongated, compressed, covered with minute scales. Spinous dorsal fin present but reduced to a row of spines. A barbel below chin.

1. Aulostoma chinensis Lacépède.

Painted Flutemouth


D. VIII-XII, 24-27; A.4,22-45; p. 17; V.6.

Body elongate, a barbel below the chin. Snout long. Second dorsal and anal fins at extreme posterior. Pelvics beneath spinous dorsal and midway between eye and caudal base. Colour: Varies according to age and the environment. Generally brownish or yellowish with cross-bars or narrow longitudinal white patches. (Fig. 1).

Habitat: Only one specimen, 14 in long, was studied by me in the catches of M.F.V. Jalwa of the Marine Fisheries Department in 1964.

Family Fistularidae.—Body is much depressed, long. Skin smooth. Dorsal and anal fins composed of undivided rays. Caudal forked, with one or two of its median rays much elongated.

2. Fistularia villosa Klunzinger

Flute mouth


1955. Fistularia villosa, Munro, Fishes Ceylon, p. 80

D. 13-15; A, 13-15; p. 13; V. 1/5

Body elongate. Snout long. Mouth terminal, slightly cleft. A serrated ridge from anterior upper angle of eye to nostril and extending to about middle of snout. Caudal forked, one median filament very much elongated.
THE BRACHYURAN LARVAE OF W. PAKISTAN HATCHED IN THE LABORATORY

Part II.—Portunidae: Charybdis (Decapoda: Crustacea)

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(Received September 9, 1968; revised October 14, 1968)

Prezoea and first zoea of four species of swimming crabs (family Portunidae) of sub-family Lupinae are obtained by rearing the female in the laboratory. They are described here.

Introduction

The larvae of crabs within the family Portunidae have received more attention than larvae from any other single group, but many species have been described only in part. Most of the commercially important crabs belong to this family and studies on their life history have been in progress for the last hundred years.

Among the 19 species of swimming crabs, that have been recorded from Karachi, 1-4 the larvae of Neptunus (Neptunus) pelagicus, 5-6 Neptunus (Neptunus) sanguinolentus, 7-9 Charybdis (Goniosoma) orientalis 10 and Thalamita crenata have been described. 4-5 In the present paper prezoea and first zoea of four species of Charybdis (Goniosoma) are described. The descriptions of the larvae of Charybdis (Goniosoma) lucifera (Fabricius), Charybdis (Goniosoma) annulata (Fabricius) and Charybdis (Goniosoma) callianassa (Herbst) are new to science.

Materials and Method

Ovigerous females of four species of Charybdis were collected from Buleji rocks, Manora island and Korangi creek, Karachi during June to September 1965. They were brought into the laboratory and maintained separately at 28°C and 35 ppt salinity and fed fresh shrimps. Methods of rearing, preservation and drawings were the same as employed in earlier paper.

Moulting Periods

Eggs of all the four species of Charybdis hatched into prezoea and after about 4-8 hr changed into first zoea by shedding the embryonic cuticle. First zoea lived for 4-5 days and then died without moulting.

Description of Larvae

1. Charybdis (Goniosoma) lucifera (Fabricius).—
Prezoea: It is 1937 µ length; the dorsal and rostral spines are equal in length (19 µ); a pair of lateral spines (58 µ) also emerge on cephalothorax.

Abdomen: Pair of lateral knobs of second segment are pointed upwards and of third segment pointed downwards; postero-lateral spines of segment three to five, overlapping the next segment; telson; fork depth is more than the body length (132 and 73 µ respectively).

Antennule is short (88 µ) and bears two aesthetes and two small setae.

Antenna: Protopodite (156 µ) is smaller than the rostral spines of the cephalothorax; bears small teeth on its distal half; exopodite (58 µ) bears two setae.

Mandible bears three large teeth.

Maxillule bear six (2+4) plumose setae on coxal endite; five setose spines on basal endite; six plumose setae on terminal and one on basal segment of the endopodite.

Maxilla bears five (2+3) plumose setae on coxal endites; eight (4+4) on basal endites; six on endopodite; three thick plumose setae emerge on the margin of the scaphognathite which terminates as a seta with hair.

First maxilliped has eight setae on the basis; four swimming setae emerge on the exopodite; five segmented endopodite bearing 3, 2, 0, 2, 4+1 setae respectively.

Second maxilliped has four setae on the basis; four swimming setae emerge on the exopodite; three segmented endopodite bearing 1, 1, 3 setae respectively.

First zoea: (Figs 1 and 2). It is 1544 µ in length; the dorsal spine is much longer than the rostral spine of the cephalothorax (411 and 294 µ respectively); a pair of lateral spines (100 µ) (Fig. 1 a and b) there are five to eight small sharp teeth.
THE LARVAE OF ELAMENA (HYMENOSOMIDAE) AND PINNOTHERES (PINNOTHERIDAE) HATCHED IN THE LABORATORY (DECAPOD: CRUSTACEA)

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(Received September 5, 1968)

Only one species of the family Hymenosomidae and one of the family Pinnotheridae have been hatched in the laboratory. First and third zoeal stages of Elamena cristatipes and first, second and third of Pinnotheres placunae have been figured and described.

Introduction

There are eight species of the family Hymenosomidae and only one species of the family Pinnotheridae recorded from Karachi. One species of the genus Elamena and one of the genus Pinnotheres have been reared in the laboratory. First to third zoeal stages of both were obtained but unfortunately the specimens of the second zoeal stage of E. cristatipes have been lost during the transit of material from Pakistan to England hence only first and third zoeal stages of Elamena cristatipes (Gravely) and first to third of Pinnotheres placunae (Hornell and Southwell) have been figured and described here.

Very little is known about the larval Oxyrhyncha of Indopacific region except Prasad and Tampi on Elamena sindenses (Alcock) and Al-Kholy on Elamena mathaei (Oesmarest).

However, from other parts of the world extensive research has been done on this group of decapod Crustacea. Cano described the larvae of Maia verrucosa from the Mediterranean. He also described the larvae of Liss, Herbstia, Acanthonyx and Lambrus. Lebour described the larvae of British Oxyrhyncha of the genus Maia, Eurynome, Pisa, Hyas, Inachus, Macropodia and Achaetus but none from the genus Elamena. Aikawa described the first zoea of the family Hymenosomidae and genus Phynoplax, Trigonoplax and Halicarcinus only. The same author described the prezoa of Chioneocetes opilio from plankton. Gurney described the zoea of Maia squinada and Elamena mathaei but he mentioned that, due to the absence of common characters in the zoea of the family Hymenosomidae and other Oxyrhyncha, they must not be grouped together.

First zoea of only Pinnotheres ridgewayi (Southwell) has been described by Prasad and Tampi. Chhapgar gave only the dia of eggs of this species in ml Hyman has described the zoeae of a number of species of this family from America as follows: Pinnotheres ostreum (Say); P. holothuriae (Semper); P. pisum (Latreille); P. veterrum (Bosc); and P. maculatus (Say). Smith described the transformation of last zoeal stage into a megalopa in P. chaetopterana. Hart described the larvae of this family found in British Columbia; Sandoz and Hopkins described the zoea of Pinnotheres ostreum (Say); Foxon described the last zoeal stage of P. sayana only.

Hence the description and figures of both Elamena cristatipes (Gravely) and Pinnotheres placunae (Hornell and Southwell) are given here for the first time.

Materials and Method

Ovigerous female Crabs were collected from Buleji rocks, Manora Island and Korangi Creek, Karachi during June to September 1965. Methods of rearing, preservation and drawings were the same as employed in earlier papers.

Moulting Periods

The first zoeae hatched direct from the eggs of Elamena cristatipes moulted after 4 days into second stage which moulted after 5 days into the third zoea. This stage remained mostly near the bottom and died after only 5 hr. The first zoeae of Pinnotheres placunae hatched from the eggs were very active. They moulte into the second zoea after 5 days which took 4-5 days to become the third stage. None survived after few hour in this stage.

Description of Larvae

1. Elamena cristatipes (Gravely). (Fig. 1-5).

First zoea: (Figs. 1 and 2) It is a small zoea measuring 908 in length; only rostral spine is present (very small (100μ) and blunt (Fig. 1a); cephalothorax globular (Fig. 1b); eyes sessile.
STUDIES ON SOME BASIC ASPECTS OF UTILIZATION OF SUINT RECOVERED FROM PAKISTANI WOOLS

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(Received August 17, 1968)

Suint contents of four of the leading Pakistani carpet wools and also of waste scouring liquors from the mills were determined. The suint obtained was calcined and analysed for the major basic ions (potassium, sodium and calcium) and the acidic ions (sulphate, chloride, silicate, phosphate and carbonate). Attempts were made to crystallize fractions from suint, as an alternative procedure to calcination, aiming at the utilization of the suint. Hydrochloric acid was found to be more effective than sulphuric acid in facilitating crystallization and the optimum pH lay between 2 to 3.

Introduction

In order to remove the various impurities, raw wool is subjected to scouring, as one of the initial steps, in both woollen and top-making processes. The waste scouring liquors thus contain grease and suint in addition to dirt particles. The grease is recovered in most leading industrial areas, whereas suint is rarely isolated for further utilization on industrial scale. This part being rich in potassium salts can be used as a source for potassium fertilizers.

A preliminary survey indicated that carpet type of wool grown in such tropical areas as West Pakistan was poor in grease content but, on the other hand, normal or rich in suint content. The recovery of suint, therefore, could well be an economical proposition in such areas.

It may be pointed out that suint, as most biological products, is not uniform in composition, its components may vary from fleece to fleece and its characteristics, such as pH, may be influenced by the various environmental and physiological factors. On an overall basis, it is a complex substance comprising a number of organic and inorganic components. In fact, beginning with Vauquelin's work in 1802, volatile and non-volatile fatty acids, some dicarboxylic acid, nitrogenous materials which may include peptides, urea, amino acids, nitrogenous bases and possibly phenols, certain neutral materials, carbohydrates, and potassium as the major inorganic ion associated with the acidic constituents have been identified to be present in variable quantities as summarised by Howitt and Preston. On a quantitative basis, however, the composition may be put to be roughly as (i) inorganic anions and cations 56%, (ii) ampholytes 3%, (iii) neutral components 5%, and (iv) organic acids 34%.

In a contemporary study, some of the basic aspects of the recovery of wool grease in Pakistan have been investigated. The present work was concerned with some of the important issues of recovery of potassium salts from the waste scouring liquors in the country. The objectives of this work were thus:

(a) to scan the suint contents of some of the typical wool types in Pakistan as well as of the waste scouring liquors, obtaining from the mills,

(b) to analyse the above samples of suint for their major components, and

(c) to investigate some of the important aspects of economical recovery of potassium-rich fractions from the indigenous suint.

Materials and Methods

Wool Samples.—Samples of four leading indigenous wool types (Hashtnagri, Kaghani, Makrani and Michni) were employed. In addition scouring liquors from a large scouring train at Karachi as well as from a woollen mill up-country were also included in the study. The latter have been described frequently as 'commercial' samples in this paper.

Extraction and Incineration of Suint.—The wool sample was opened out manually and dusted to remove as much extraneous matter as possible. This was followed by extraction with distilled water at room temperature. In order to ensure complete removal of the suint, washing was repeated (3-5 times) till a clear extract was obtained. The extracts were combined and concentrated by evaporation at a metal plate heater. The suint
STUDIES ON THE RELATIONSHIP BETWEEN THE CRIMPS/INCH, DIAMETER AND THE STAPLE LENGTH OF CROSSBRED KAGHANI WOOL FIBRES FOR ASSESSING THE WOOL QUALITY

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(Received July 8, 1968)

Studies have been carried out on 20707 staples contained in 180 samples of crossbred Kaghani wool in order to determine a relationship between the crimps/in, diameter and staple length. Out of 20707 staples only 2567 staples showed an agreement with the standards of crimps and those of fibre fineness. It was found that the crimp frequency varied between 10–12 crimps/in and 1–2 crimps/in with mean diameters of 16.5 μ and 45.2 μ and mean staple length of 1.7 and 5.0 in respectively. The results were compared with American and English wool grades and A.S.T.M. standard for quality assessments.

Introduction

In estimating the value and suitability of wool for yarn manufacturing purposes crimps/in, diameter and staple length are the three most important characters to be considered. Crimp in wool fibre is an important feature in processing and it may influence the handle and bulkiness of fabrics.

Crimps play a most important part in the visual estimation of wool quality and assessments of values in commercial transactions, partly because they are a guide to the estimation of fibre diameter, with finer fibres usually having more crimps per inch. Visual assessment of wool quality of staple crimp frequency may, however, in some instances, lead to considerable errors.

Uniformity of crimp has also been taken as indicating uniformity in diameter, although this point is still disputed. It appears that the influence of crimp on processing has been over-emphasised.

Subjective assessments of raw wool are largely influenced by staple crimp and by softness of handle, both of which are related to mean fibre fineness. The spinning performance of tops and the properties of yarns are largely determined by fibre fineness and to some degree fibre length; the latter being important when spinning near the “limiting yarn count”. It was observed that wool with fewer crimps per inch spin near the limit on the “amblar super draft” have “fewer ends down” than those with higher crimps per inch, but the reverse was the case when a conventional system was used. There are other properties which are important in cloth finishing. These could be well associated with crimp type since there is evidence that the ratio of ortho to paracortex, as well as the fibre fineness, influences the crimp.

The relationship between fibre fineness and crimps depends upon the individual breed, the geographic location of the sheep, their age and the part of the fleece from which the wool is derived.

A general study of crimps per inch, diameter and staple length has been undertaken on the well-defined staples of 180 samples of crossbred Kaghani wool (Rambouillet x indigenous Kaghani breed) collected in July 1967. Results of these measurements were compared with the American, English wool grades and also with A.S.T.M. standards quality designation.

Materials and Methods

Out of 180 samples of crossbred Kaghani wool 20,707 staples have been observed. Selection has been made of only 2570 staples which have sound, well-grown and clearly defined crimp while unevenly grown wool staples with ill-defined crimps have been discarded.

Crimps Measurements.—The crimps per inch were measured by counting the number of waves corresponding to one inch on a scale placed alongside the staple. Measurements were taken at three different places along the length of the staple to get an average.

Diameter Measurements.—The staples after finding the crimps/in were treated with benzene and thereafter with ether to remove dirt and other impurities. These were then cut into small pieces and slides were made. The diameter was measured at ×500 magnification with a lanameter. Twenty to twenty-five readings were taken for each staple.

Length Measurements.—The length of the individual staples were measured against ordinary ruler under slight tension and the distance between the two ends were noted.
STABILITY AND MODIFICATIONS OF WOOL CRIMP AND THEIR EFFECTS ON FELTING AND COMPRESSION

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(Received August 24, 1968; revised October 24, 1968)

Samples of two wools Merino and Southdown differing widely in crimp form were treated in ether, alcohol, water at 21°C and 40°C, sodium iodide, formic acid and thioglycollic acid and their crimp parameters measured. Felting and compressional tests were also carried out on these treated wools. The relationships among felting, compressional load and crimp form were investigated.

Woods in 1935 emphasised that fibres within the staple are generally in a state of strain, due to the closeness of packing within the fleece. He defined "cohesive set" which can be removed by immersing a wool fibre in cold water and "temporary set" which is removed by application of water at a higher temperature than that at which the effect was produced. When these two sets have been removed, the fibre is in "structural form". Goldsworthy and Lang demonstrated that coiling of wool fibres immersed in different liquids is due to the relaxation of pre-existent strains in the fibre. They argued that the strain could be resolved into reversible and non-reversible effects so that coiling could occur during both wetting and drying. Horio and Kondo have shown that wool fibres are bilateral in their cortical structure and that the coiling properties of the wool fibre originate from the dual structure.

In the past, three different forms of crimp have been suggested, namely twisted sine wave, helix and sine wave. Further, it has been shown recently that crimp form plays an important part in felting and compressional properties of wool fibre. The present work was undertaken, firstly, to study the effect of hydration and swelling agents on the form of crimp and, secondly, to study the felting and compressional properties of wool treated in various liquids.

Materials and Methods

Two different types of wool Merino 64s (predominantly sine form) and Southdown wool (predominantly helical form) were selected and the following tests were carried out.

Crimp Form in Different Liquids.—Twelve fibres about 3-3.5 cm in length were withdrawn from staples for measurement of crimp form, crimp amplitude and crimp frequency. After each treatment, the fibres were condition for 24 hr at 65% R. H. and the crimp parameters again measured.

The following is the order of treatment in different liquids:

1. Raw wool.
2. Diethyl ether at 21°C for 10 min.
3. Ethyl alcohol at 21°C for 10 min.
4. Water at 21°C for 1 hr.
5. Water at 40°C for 1 hr.
6. Sodium iodide 8.3M was used and the wool fibres treated overnight at 25°C and then thoroughly washed with distilled water.
7. Wool fibres were treated for half an hour with formic acid at 21°C (98%) and then washed with distilled water.
8. Thioglycollic acid (90%) was applied to the wool fibres for about 10 min at 21°C.

Compression Tests on Treated Wools.—The wool was hand-carded and randomized to minimize sampling differences and treated in different liquids as described above. Exactly 1g wool was placed in a cylinder 7.5 cm long and 3.47 cm internal diameter containing a freely moving piston and attached to an Instron Textile Tester fitted with automatic integrator. The speed of the piston was kept at 2 cm per min in the forward as well as in the reverse cycle. In use, the piston was lowered to a depth of 6.5 cm corresponding to a compression of 86% of the original volume. From the area of the graph, resilience was calculated. The second cycle was commenced 1 min later and the wool was compressed through four cycles.

Felting Tests on Treated Wools.—The samples used for compression were also used for felting, after carding and conditioning.
A STUDY OF ELEPHANT GRASS (TYPHA ELEPHANTINA ROXBI) FOR TEXTILE PURPOSES

Part I.—Physical and Chemical Examination of the Fibres

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(Received June 13, 1968; revised October 2, 1968)

Typha elephantina Roxb (elephant grass) is a leaf fibre cheaply and abundantly available in Pakistan. In order to assess its suitability for textile manufacture, some of the important fibre characteristics were studied. A detailed study of fibre diameter was undertaken. The rheological properties such as breaking strength, elongation, stress, tenacity and tensile strength were also studied. Relationships of diameter to strength, stress, and tensile strength were investigated. Further chemical analysis of the fibre for its major components was carried out. Keeping in view its properties, the suitability of the fibre for various textile purposes was discussed.

Vegetable fibres can be classified into various groups; among them long vegetable fibres are divided into two categories, bast and leaf fibres. Leaf fibres are often termed "hard" fibres because they are generally harder, stiffer and coarser in texture than those in the best fibre group. In bast fibres the most important are jute, flax and ramie, while in leaf fibres, abaca, sisal and henequen account for more than 80% of the commercial leaf fibre production. The principal use is for various types of cordage and twine, though the fibres are also used in the manufacture of woven fabrics.

On the botanical side Typha elephantina is a perennial, marshy herb, 6–12 ft high, leaves erect, spongy, 3-cornered margins, wavy about the middle. This grass-like shrub is planted as a soil binder. The long strong roots bind the soil of the river banks and prevent them from falling in. The plant is used for making ropes, mats and baskets by the local people.

In Pakistan considerable work has been done on such vegetable fibres as those from jute and banana, but little attention seems to have been given to the use of other vegetable fibres. Typha elephantina is a leaf fibre abundantly and cheaply available in marshy places, such as the Indus Delta, Jhelum and the Gujrat Districts. In this paper, important fibre characteristics such as the diameter and the mechanical properties as well as the composition of the fibre have been studied in some detail to assess its suitability for textile purposes.

Materials and Methods

The plant was obtained from marshy places near Peshawar in dry form. It was soaked in water for about a week, the water being replaced from time to time. When the plant became soft, the fibre could be removed easily. The fibre was taken at random from all parts of the plant. The following tests were made on 10 samples used in the present study. Each sample represents one complete plant.

Diameter.—About 200 readings were taken from each sample by the Lanameter method ($\times 500$). The coefficient of variation (C.V.) was determined by using the rapid method.

Mechanical Properties.—The strength characteristics of the fibres were measured employing a Schopper dynamometer (constant rate of loading). About 20 fibres were measured from each sample for breaking strength and percent elongation and the corresponding stress, tenacity and tensile strength calculated. The tests were carried out on fibres conditioned at 65% R. H. and 20°C as well as on wet fibres (soaked in water for 24 hr). Fibres were withdrawn easily from the tip and root ends of the plant and their breaking strength measured.

Fibre Analysis.—In order to elucidate the composition of the fibre percentage cellulose, hemicellulose, lignin, wax and moisture were determined. Briefly, loss in weight resulting from treating with sulphuric acid as described by Howlett, was the cellulose content. The hemicellulose content was the loss in weight resulting from treatment with sodium hydroxide by Jengton’s method. For lignin, the sulphate process was adopted wherein the material dissolved in alkaline solution, keeping pH above 9, determined the lignin content. Wax, aqueous extract and moisture were determined by the usual procedures.
SHORT COMMUNICATION


EFFECT OF A VERY SMALL QUANTITY OF LONG-CHAIN POLYMER ON THE POINT OF MAXIMUM DENSITY OF WATER

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(Received September 2, 1968; revised April 17, 1969)

SPECTRAL STUDIES ON ALKALOIDS

Part IV.—The Identification of Berbericine Hydroiodide as Palmatine Iodide

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And

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(Received April 11, 1969)

REGENERATION IN RELATION TO ROOT SIZE IN TARAXACUM OFFICINALE*

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Department of Botany, University of Karachi

(Received February 24, 1969)

OBSERVATION ON THE SEASONAL INFESTATION OF THE SUGARCANE TOP SHOOT BORERS IN EAST PAKISTAN

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ACHERONTIA STYX WESTV. LEPIDOPETRA: SPHINGIDAE

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ACHERONTIA STYX WESTV. LEPIDOPETRA: SPHINGIDAE

A Pest of Medicinal Plants – Two New Record

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