PHARMACOGNOSTIC STUDY OF THE STEM AND LEAF OF LANTANA INDICA ROXB

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Introduction

Lantana indica Roxb. is a member of the family *Verbenaceae*.[1] The small shrub with yellow flowers is widely distributed throughout the Indo-Pakistan sub-continent. Its leaves are used as cure for snake bite in the indigenous system of medicine.[2]

Lantana indica Roxb. is an erect shrub 2-3(–8) feet high. Twigs are not prickly and densely hairy upwards. Leaves opposite, 1-3×1.7-4″, ovate scabrous above and with prominent veins beneath, subacute, base narrow, serrate, petiole 1.3″ long. Flowers 0.2″ across, yellow in ovoid heads, peduncless 1-3 inches long slender, quadrangular, hairy. Calyx 0.05—0.06″ long, truncate, hairy. Corolla tube about 0.25 inches long, hairy outside, lobes 4, rounded. Stamens 4. Style 1. Stigma oblique, Fruits drupes.

Material and Methods

The material was collected from the Experimental Farm of North Regional Laboratories, Peshawar. The stem and leaf pieces were fixed in formaline aceto-alcohol for microtome sectioning. After a period of 12 hours the material was taken out from the fixative and it was dehydrated by normal butyl alcohol and ethyl alcohol. The parrafin embedding was done according to Zirkle's method.[3] The microtome sections were stained by safranin and fast green. The maceration of the tissue was carried out by Jeffery's method,[3] while fresh hand sections were cut for micro-chemical tests as given by Johansen and E. Gurr.[4] A uniform powder of the material was obtained by sifting it through 60 mesh sieve and the powder was studied after clearing it in 50% chloral hydrate. Cell measurements were taken with the help of the eye piece micro-meter.

Description of the Stem

Macroscopic Characters.—The stem is green, quadrangular and varying from 2 to 10 mm. in diameter (Fig. 1). The odour of the powdered stem is not distinctive and taste is bitter.

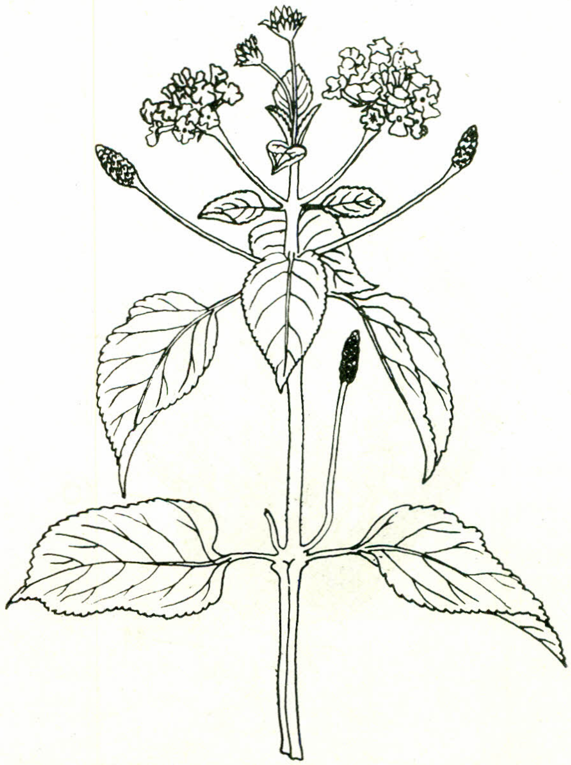

Fig. 1.-Showing shoot of *Lantana indica*.

Microscopic Characters.—The T.S. of the stem is quadrangular in outline. Trichomes are present on the surface. The stem is outlined by a single layered epidermis, the cells of which are rectangular in shape. The epidermal cells measure 23.84-34.0 (–44.2)μ in length and 10.2—15.6 (–17.0)μ in breadth. In a young stem, beneath the epidermis occurs 7 layered band of collenchymatous cells (Fig. 8). In older stem collenchyma forms a continuous ring around cortex. In fresh hand sections, the walls of the collenchyma are shining while in a stained ones this layer can be differentiated by its deep stain. Below the collenchymatous band is 20-layered cortex, the cells of which are thin walled (Fig. 2). Cortical cells in T.S. measure about 20.4-29.4 (-37.4)μ in length and 13.6-15.8 (-17.0)μ in breadth. The cortex is traversed by bands of sclerenchymatous fibres which measure about 429.0-568.0 (-715.0)μ in length and 14.3-23.8 (-28.6)μ in breadth (Fig. 3). In older stems the endodermis is ruptured due to secondary growth and not visible. Pericycle is absent. Only a limited amount of secondary growth takes place due to the activity of vascular cambium. The primary phloem elements are transferred later on into phloem fibres which are scattered in the peripheral region of the vascular bundle. The secondary phloem formed through the activity of the vascular cambium is 5 to 6

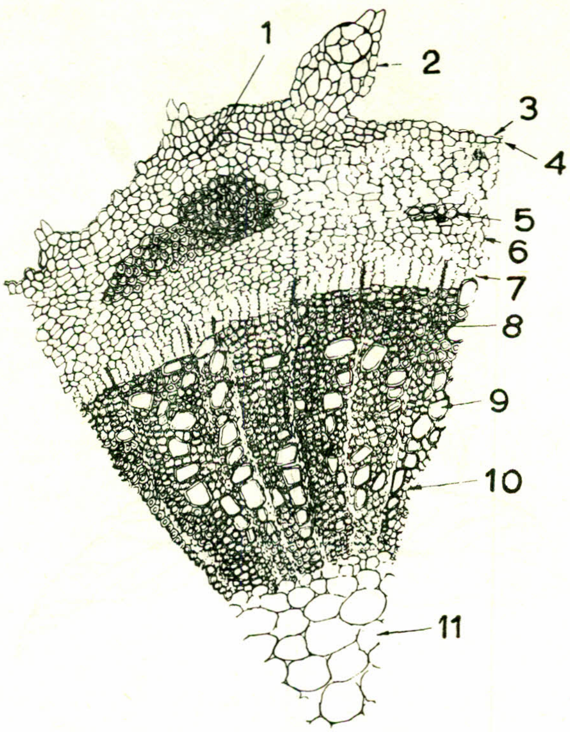

Fig. 2.—Showing T.S. *Lantana indica* stem (after Sec. Growth). [1, Collenchyma; 2, Trichome; 3, Cuticle; 4, Epidermis; 5, Pericyclic sclarenchyma; 6, Cortex; 7, Phloem; 8, Medullary ray; 9, Xylem vessels; 10, Xylem; 11, Pith].

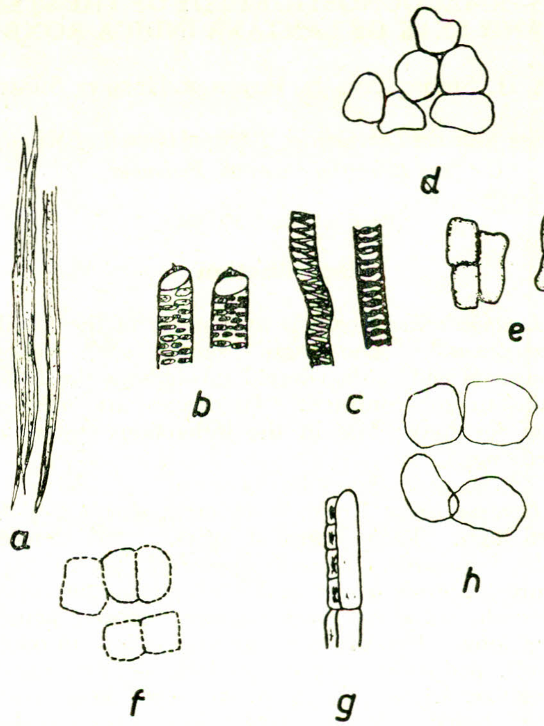

Fig. 3.—Showing macerate of *Lantana indica* stem. [a, Fibres; b, Vessels; c, Tracheids; d, Cortical cells; e, Epidermal cells; f, Xylem parenchyma; g, Sieve tube].

layers in thickness. The phloem is made up of sieve tubes, companion cells, phloem parenchyma and phloem fibres. The xylem is cylindrical and occupies 1/3 of the entire diameter of the stem, in older specimens. This cylinder is traversed by uniseriate, biseriate and multi-seriate rays. The secondary xylem formed by the activity of vascular cambium is composed of vessels, tracheids, fibres and xylem parenchyma. The vessels are generally of medium size with pitted thickening. Pitting is of bordered type. The vessels measure about 300.0-535.3 (–662.1)μ in length and 28.6-39.5 (–57.2)μ in breadth (Fig. 3). The tracheids vary in their shape. The thickenings are generally of spiral and annular type. They measure about 243.1-406.6 (–562.0)μ in length and 28.6-37.9 (–42.9)μ in breadth. Thick-walled and pitted fibres are also seen in the xylem which measure about 429.0-568.0 (–715.0)μ in length and 14.3-23.8 (–28.6)μ in breadth. (Fig. 3). The xylem cylinder encircles the pith, which is parenchymatous and thin-walled.

Description of the Leaves

Macroscopic Characters.—The leaves are arranged in opposite manner. They are numerous, stalked, ovate and 1-4″ long. They are rough above and hairy beneath. Stomata are present on the lower surface. Margins are serrate. The odour of the powdered leaf is not distinctive and taste is bitter.

Microscopic Characters.—Transverse section of the leaf shows a thin layer of cuticle and glandular, simple, multicellular and unicellular hairs. (Fig. 4). The epidermal cells are almost rectangular in shape. The particular feature of the leaf is the presence of glandular trichomes. Below the epidermis, palisade parenchyma occurs in two layers and is filled with chloroplasts. The palisade cells measure about 28.6—42.9 (–57.2)μ in length and 14.3—19.0 (–28.6)μ in breadth (Fig. 5). The palisade cells of upper epidermis are longer than the lower epidermis. In the midrib region of the leaf is a band of collenchymatous cells, which is followed by the cortex consisting of parenchymatous cells. Spongy parenchyma which occurs below the palisade parenchyma is composed of parenchymatous cells with intercellular air spaces.

The unsheathed vascular bundle, embedded in the cortex, is crescent shaped. The xylem elements are towards the upper side of the leaf while

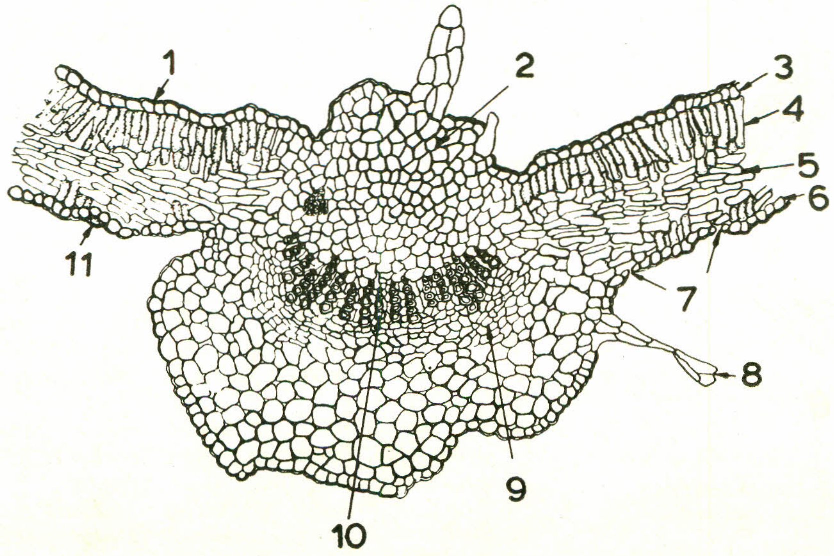

Fig. 4.—Showing T.S. of *Lantana indica* leaf [1, Cuticle; 2, Collenchyma; 3, Upper epidermis, 7, Stomata; 8, Trichome, (glandular), 9, Phloem; 10, Xylem; 11, Base of trichome].

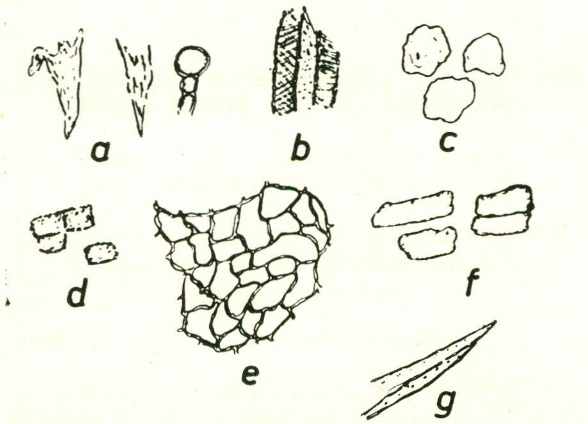

Fig. 5.—Showing *Lantana indica* (Mag. 10×12). Powdered leaf. [a, Trichome; b, Tracheids, and Vessels; c, Water storage cells; d, Xylemparenchyma; e, Upper epidermis; f, Palisade cells; g, Fibres].

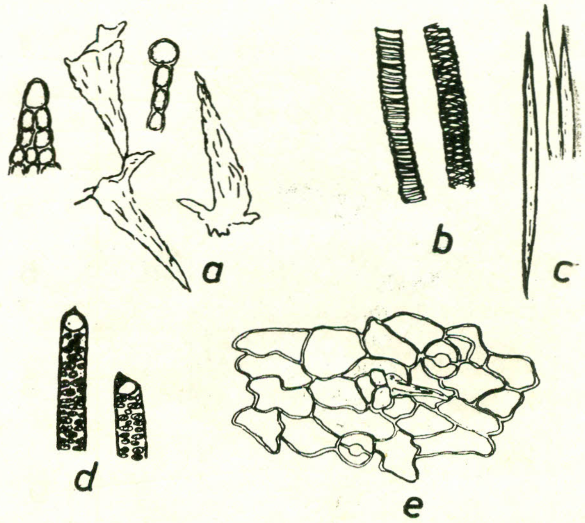

Fig. 6.—Showing macerate of *Lantana indica* leaf. (Mag. 10×12). [a, Trichome; b, Tracheids; c, Fibres; d, Vessels; e, Lower epidermis].

the phloem elements are towards the lower side. The xylem is composed of pitted vessles, spiral and scalariform tracheids, fiber, and xylem parenchyma. Vessels measure about 157.3—280.9 (—457.6)μ in length and 28.6—42.9(—57.2)μ in diameter; tracheids which have spiral and scalariform thickenings measure about 357.5—476.3 (–643.5)μ in length and 28.6—39.5 (—57.2)μ in breadth (Fig. 6). The fibres are long, pointed, thick-walled cells measuring about 357.5—42.8 (—500.5)μ in length and 14.3—21.4 (–28.6)μ in breadth. The phloem consists of sieve tube and phloem parenchyma.

Powdered Stem.—The powder of the stem is buff in colour without distinctive odour and with bitter taste. The epidermis, cortical cell, trichome, fibre, and tracheid (Fig. 7) are visible under microscope.

Powdered Leaf.—The powder of the leaf is green in colour without distinctive odour and with bitter taste. The epidermis, trichomes, palisade cells, water storage cells, tracheids, vessels and xylem parenchyma are visible under microscope.

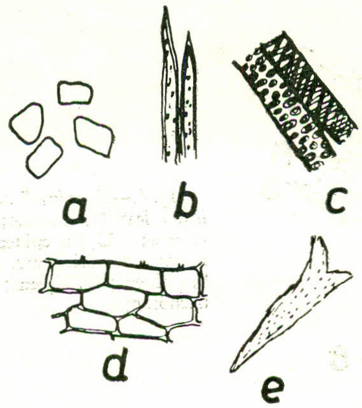

Fig. 7.—Showing powdered stem of *Lantana indica* (Mag. 10×12). [a, Cortical cells; b, Fibres; c, Vessels and tracheids; d, Epidermis; e, Trichome].

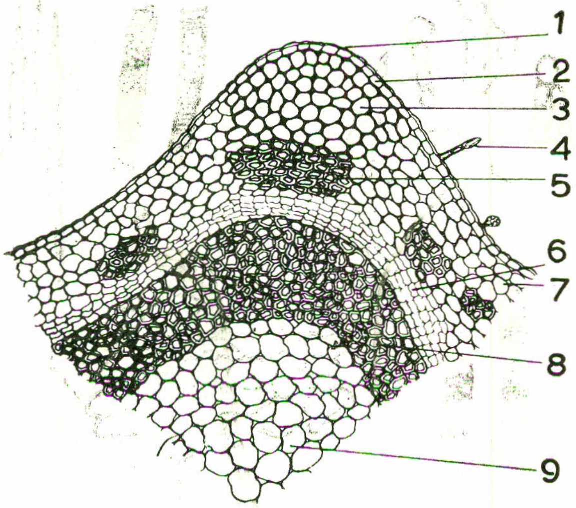

Fig. 8.—Showing T.S. of the young stem of *Lantana indica* [1, Cuticle; 2, Epidermis; 3, Collenchyma; 4, Trichome; 5, Pericyclic sclarenchyma; 6, Phloem; 7, Parenchyma; 8, Xylem; 9, Pith].

Microchemical Tests.—Chemical tests as described by Johansen[3] were carried out for microchemical analysis of the stem and leaf. The stem indicated the presence of chitin and protein in the epidermal and cortical cells and gave positive tests for alkaloids. The leaf showed the presence of protein in the cells of epidermis and cortex and also indicated the presence of alkaloids.

Acknowledgement.—The authors are thankful to Dr. S.M.A. Kazmi, Senior Research Officer, for his guidance. Thanks are also due to Dr. S.A. Warsi, Director, North Regional Laboratories, for his keen interest in the work. Thanks are also due to Mr. Syed Ali Shah for his co-operation in photographic work.

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STUDIES ON THE TENSILE CHARACTERISTICS OF TERAHI WOOL FIBRES

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Various samples of Terahi Wool also known as Parai or Afridi collected from the home tract *i.e.*, Terah situated along the south-west of Peshawar near the boundary of Afghanistan, were tested for physical characteristics, such as diameter, elongation and breaking strength and consequently stress, tenacity and tensile strength were calculated.

Experimental

Each sample was first cleaned, sorted into true, heterotypical and medullated types of fibres with the help of benzene test.[1] Fibres in each class were counted and their proportions worked out mathematically. The methods used for determination of breaking strength and elongation and calculation of stress, tenacity and tensile strength are the same as described by A.A. Wakil and Amir Mohammad[2] in their work on Kaghani wool fibres.

Results

The results of medullation test show that the average fibre type content in the 30 samples is 60.1% true wool, 18.8%, heterotypical and 21.1% medullated wool. The variation in the medullated fibres is from 5.6% to 36.4%; in heterotypical fibres from 8.3% to 30.9%; in true fibres, from 35.7% to 75.2%.

The general range in diameter of true wool fibres is (10-50 μ); heterotypical (10-100 μ); and medullated (30-140μ) while the mean range of true is (18.4-22.2μ); heterotypical (35.6-44.4μ) and medullated (66.6 94.8μ). The mean diameter of these fibres is 20.2 μ, 39.5μ and 79.2 μ.

So far as the elongation of the fibres is concerned, 50% of the heterotypical and 51.5% of true and medullated wool fibres are elongated within the same range (30%-35%). A maximum number of true wool fibres 37.7% have breaking strength from 24 to 27 g. and medullated wool fibres 24.8% have breaking strength from 36 to 39 g.

The relationship between diameter and breaking stress for the three types of wool are shown in Fig. 1. The curves are linear and each curve

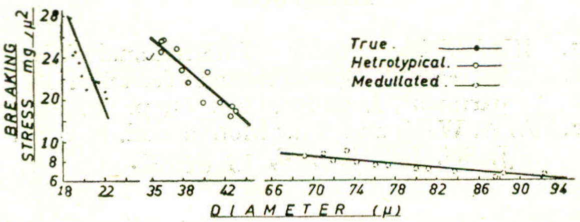

Fig. 1,—Showing relationship between Dia (μ) and breaking stress of True, Heterotypical and Medullated fibres of Terahi wool.

shows that the stress increases as the diameter decreases. The mean values of the physical characteristics are given in Table 1. Standard deviation and co-efficient of variation are reported in Table 2.

Discussion

The mean diameter of true (20.2μ) and heterotypical (39.5μ) wool fibres is less than the mean diameter of true (29.2 μ) and heterotypical (40.0μ) fibres of Kaghani wool. It has, however, nearly the same mean diameter of true (20.8μ) and heterotypical (39.8 μ) fibres of Lohi wool. The medullated fibres are very coarse and the mean diameter of medullated (79.2 μ) wool fibres is the greatest of all the breeds tested so far. The mean breaking strength of true (7.3 g.) wool fibres is the least and the mean breaking strength of heterotypical (26.3 g.) and medullated (36.6 g.) wool fibres is the greatest of all the breeds tested before.

The mean range in diameter of true wool together with the heterotypical wool fibres is from 18.4 μ to 44.4 μ and the wool used in textile industry ranges in diameter from 18 μ to 40μ. Another thing which is important for weaving apparel cloth is that it must have sufficient strength so as to withstand the wear and tear. The breaking strength of heterotypical fibres is much, but the breaking strength of true wool fibres is very little unlike Kaghani wool fibres in which true wool fibres are stronger than the heterotypical wool fibres. The low value of breaking strength of true wool fibres is the only draw back, otherwise Terahi wool could have served the purpose of a good raw material for weaving woollen cloth.

Another point to be mentioned here is that Terahi wool is soft. Softness is a property which counts much for weaving apparel cloth and it can be assessed only by touch (a soft wool has a kind handle where other wools may be harsh). A soft wool having a minimum of 25% elongation is desirable for weaving apparel cloth. It has been found that the three types of Terahi wool fibres come close to this specification and they may be regarded as suitable for weaving medium quality apparel cloth.

Of all the samples of Terahi wool tested, the course fibres are 5 times stronger than the fine wool fibres, while in Harnai wool the coarse fibres are only 4 times, stronger than the fine wool. The medullation of true and heterotypical fibres and their mean diameter come close to the range of carpet standards. Values of standard deviation and coefficient of variation are very small. The values of coefficient of correlation between fineness and breaking strength are excellent, but in case of tensile strength, there exists no correlation at all. The average breaking strength per fibre is 7.3-36.6 g. (mean 23.4 g.) and tensile strength 849-2500 kg./cm.^{2} mean (1870 kg./cm.^{2}).

Conclusion

The results of the present studies show that the Terahi wool fibres are suitable for manufacturing medium to low quality of woollen cloth and carpet.

TABLE 1.—MEAN VALUES OF ALL THE TRUE, HETEROTYPICAL AND MEDULLATED WOOL FIBRES.

Type of fibres.	Diameter μ	Breaking strength: Single fibre g.	Breaking strength: Bundle kg.	Elongation %	Stress mg./μ^2	Tenacity g./denier	Tensile strength kg./cm^2.
True	20.2	7.3	1.7	31.6	23.0	1.90	2261
Heterotypical ..	39.2	26.3	2.2	34.3	21.6	2.06	2500
Medullated ..	79.2	36.6	2.6	29.9	7.5	0.71	849

TABLE 2.—STANDARD DEVIATION AND CO-EFFICIENT OF VARIATION OF DIAMETER, BREAKING STRENGTH, STRESS AND TENSILE STRENGTH OF TRUE, HETEROTYPICAL AND MEDULLATED WOOL FIBRES.

Type of fibres	Standard deviation: Diameter	Standard deviation: Breaking strength	Standard deviation: Stress	Standard deviation: Tensile strength	Coefficient of variation %: Diameter	Coefficient of variation %: Breaking strength	Coefficient of variation %: Stress	Coefficient of variation %: Tensile strength
True ..	1.4	0.8	3.4	346.3	6.7	10.5	14.1	14.2
Hetero-typical ..	4.1	2.1	4.2	496.8	10.9	8.3	17.2	17.9
Medullated	8.9	2.7	1.1	108.3	11.2	7.5	14.4	12.9

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BOOK NOTICES

Physics of Plastics. P.D. Ritchie. 447 pp. D. Van Nostrand Company, Inc. Princeton, New Jersey. Price 115s.

This is the first definitive volume dealing specifically with the physics of plastics to be published. In it, ten of Great Britain's leading authorities have contributed chapters under the general editorship of Professor P.D. Ritchie.

Physics of Plastics deals with the many physical concepts related to high polymers in all their phases, including melts and solutions. The introduction contains descriptions and definitions of the elementary concepts relating to the molecular structure and organisation of polymers. It outlines some of the more usual methods of structural investigation, such as light scattering, X-Ray, infra-red and nuclear magnetic resonance spec-