length of the fiber. The ends are either round or acutely pointed.

Wood fibers vary in length, from one to three times the length of the tracheids. They are characteristically heavy-walled and highly lignified, the side walls are usually parallel with a broad cavity in the center. The ends may be round, but are usually extended to an acute or an obtuse point, and the latter may be straight or bent.

Pith cells bearing yellowish crystalline substance are conspicuous. Other pith cells may be unmodified, or possess irregular pit-like markings.

Medullary rays are distinguishable from the cells of the pith only by their longitudinal arrangement when seen in groups of two or more.

SUMMARY AND CONCLUSIONS

A comprehensive study has been made of the histology of *Salvia* stem and leaf using a single sample obtained from the United States Department of Agriculture, Bureau of Plant Industry.

Our findings do not agree completely with those reported in the recent study made by Youngken and Vander Wyk on material from another source. The differences are significant enough to suggest that more than one variety of *Salvia officinalis* may now be in use as the official drug.

The present investigation reveals the following important histological characteristics of *Salvia*. These have not been emphasized in previous publications:

1. The occasional presence, in transverse sections of the stem, of medullary rays two cells in width.

2. Concentrically arranged groups of *bast* fibers dividing the cortex of the stem into inner and outer regions.

3. The relative abundance of medullary rays and conducting elements in xylem areas beneath the angles of the stem as compared to their occurrence between the angles.

4. Tangential sections of the stem revealing groups of medullary rays varying from four to an indefinite number of cells in height.

5. While no additional types of trichomes were noted on either stem or leaf, the absence of stalkless glandular trichomes with eight-celled heads is emphasized. The latter invariably possess short and broad, one-celled stalks. Glandular trichomes with one-celled heads have unicellular stalks. Those with two-celled heads show two-celled stalks, the latter varying greatly in length.

6. Leaves in cross section occasionally contain three rows of palisade cells at the crests of undulations or near the margin. Numerous thickened areas in the lamina are due to a great increase in the number of spongy mesophyll cells. These cells tend to displace, partially or entirely, the palisade mesophyll, and, together with the undulations of the lamina, give the latter an exceedingly irregular outline.

The above references to the variations in trichome and leaf structure should appear in the National Formulary monograph of *Salvia* leaf powder.

REFERENCES

(1) Youngken, H. W., and Vander Wyk, R., "The Pharmacognosy of *Salvia officinalis*," *Bull. N. F. Committee*, VII (December, 1938) 3, 79–81.

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A Study of Athyrium Filix-Foemina

By Malcolm S. Trupp and Forrest J. Goodrich†*

INTRODUCTION

Many ferns are found growing natively in the State of Washington and several of them have been carefully investigated as to their chemical components. *Athyrium filix-fœmina* (Lady Fern) is a plant of unusual beauty and has attracted considerable attention. It is reported in the literature (1) as having anthelmintic principles in its roots, rhizomes and stipes. The purpose of the investigation was to determine whether or not it possessed anthelmintic principles similar to the official Aspidium and to ascertain the presence of significant components.

Athyrium filix-fœmina is a large non-evergreen fern found in the moist woods and near streams. The fronds are often more than a meter in length, pinnately two-three com-

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pound; the venation of the pinnule is branched and margin is serrate. Sori are found on the lower surface of the older fronds. The underground stock is conical in shape, supported by many roots. Cross sections of the rhizome and stipe show some structures which differ from those of the official Aspidium. There is an absence of a lignified outer cortex or hypodermis. The xylocentric bundles are arranged in an interrupted circle and are five to six in number as compared to six to twelve for Aspidium.

EXPERIMENTAL

The underground materials used in the investigation were collected from indigenous plants on the University of Washington campus. The product was air-dried and reduced to a No. 20 powder, and this material was used for all analyses except moisture determinations which were conducted on fresh samples. Duplicate determinations were made in all cases.

Moisture.—Ten-gram samples of the fresh material were dried to constant weight at a temperature of 100° C. Total moisture was 77.12 per cent. The moisture present in the air-dried material was 9.32 per cent.

Selective Extraction.—Ten-gram samples of the air-dried material were exhausted in a Soxhlet extractor for twenty hours with each of the following solvents and the solvents subsequently removed.

Table I.—Selective Extraction

Solvent	Extractive at 105° C. in Per Cent
Petroleum ether	0.68
Ethyl ether	0.37
Chloroform	0.25
Alcohol (95 per cent)	15.41
Water	11.99

Ash.—Total ash content was 5.22 per cent.

Alkaloids.—Twenty-gram samples were macerated in acid solution, alkalinized, filtered and the filtrate extracted with chloroform and ether. The evaporated extractives showed an absence of alkaloids when tested with various alkaloidal reagents.

Glucosides.—Various methods were tried in attempting to show the presence of glucosides.

First, The powdered material was exhausted with 70 per cent alcohol, the solvent removed under reduced pressure and the residue set aside for crystallization. The alcohol was kept neutral.

Second, The Rosenthaler process (2) was followed, using 20 Gm. of the drug, exhausting with 70 per cent alcohol for two hours, and the solvent kept neutralized with calcium carbonate. The alcohol was removed under reduced pressure and the residue taken up with water. The extraneous extractives were precipitated by lead acetate solution. The aqueous liquid was reduced to a syrupy liquid by vacuum distillation. This in turn was extracted with acetic ether. The material was extracted with water, clarified and shaken out with chloroform. The chloroform was removed by spontaneous evaporation.

None of the tests showed the presence of glucosides.

Starch.—The A. O. A. C. method was followed in the determination of starch. The yield was 3.67 per cent

Pentosans.—The A. O. A. C. method with phloroglucin and hydrochloric acid was followed. The amount present was 4.94 per cent.

Sugars.—The non-reducing sugars, calculated as sucrose and reducing, were determined by the A. O. A. C. official methods. The calculated sucrose was 3.42 per cent and the reducing sugars were 1.69 per cent.

Tannin.—The application of the usual qualitative tests for tannin on an aqueous extract of the drug indicated the presence of this substance. Five-gram samples of dried material were subjected to a quantitative determination as suggested in the official methods of the A. O. A. C. The tannin obtained amounted to 7.87 per cent of the samples taken for analysis.

Filicic Acid.—This organic material, being a physiologically active substance, it was of primary importance to learn whether it would be present in the rhizome of *Athyrium filix-fœmina* as in the official Aspidium. Although qualitative tests indicated the absence of this material, a determination was made on the ether extract using the official U. S. P. method for Oleoresin of Aspidium. This method, supplemented with that recommended by Kraft (3), gave negative results.

Toxicity.—White rats, fed the alcoholic and ether extracts of the rhizome in fairly large quantities failed to show any indications of debility or poisoning. This inability to demonstrate toxicity evidences an absence of a poisonous principle.

SUMMARY

1. Differences in structure between *Athyrium filix-fœmina* and *Dryopteris Filix-mas* have been shown.

2. Although claims have been made for the toxicity and the presence of filicic acid in the rhizomes of *Athyrium filix-fœmina*, they seem unwarranted.

3. From the results obtained, it would seem safe to say that this fern rhizome or extracts of it would be unlikely to have any value as anthelmintics.

BIBLIOGRAPHY

(1) Frye, "Ferns of the Northwest" (1934), page 124.

(2) Rosenthaler, "The Chemical Investigation of Plants" (1930), page 53.

(3) Kraft, "Foods and Drugs by Parry" (1911), page 469.

(4) United States Pharmacopœia XI (1936), pages 473–475.

(5) Pammel, "A Manual of Poisonous Plants" (1911), page 318.

(6) A. O. A. C., Third Edition, 27, (1930) 281–285; *Ibid.*, 18, (1930) 155–156.

Book Reviews

A Textbook of Bacteriology, by HANS ZINSSER and STANHOPE BAYNE-JONES. 8th ed., xxviii + 990 pages, $6^3/_4$ x $9^5/_8$. New York: D. Appleton-Century Co., 1939. Price, $8.00.

This volume is the eighth edition of this well-known work on bacteriology. The volume, which is a comprehensive one, is divided into several sections covering the morphology and characteristics of bacteria, infection and immunity. More than 400 pages are devoted to the pathogenic micro-organisms. Diseases of uncertain origin and those caused by viruses are also discussed. Practical methods of bacteriology, immunology and serology are included. The section on protozoölogy carried in former editions has been omitted. The book is recommended to pharmacists who desire to have a comprehensive treatise of this character in their library.—A. G. D.

Experimental Pharmacology and Materia Medica, by DENNIS E. JACKSON, Ph.D., F.I.C.A., Professor of Pharmacology, Materia Medica and Therapeutics in the University of Cincinnati College of Medicine; formerly Associate Professor of Pharmacology, Washington University Medical School, St. Louis. 2nd ed., 906 pages, 892 illustrations, including 55 color plates. C. V. Mosby Company, 1939. Price, $10.00.

A systematically arranged series of experiments in pharmacodynamics selected from the author's experience in teaching the subject is presented in this volume, which is profusely illustrated. The technique of all operations is described in detail, which is believed to be an advantage in books of this type. Although the book is written for medical students, there is sufficient material in it of pharmaceutical application to make it a valuable reference work for students in pharmacy. Parts of the book deal with materia medica and presciption writing and incompatibilities. There are also a solubility table, Latin-English vocabulary, a list of abbreviations and an extensive list of supply and equipment houses. The book should be in every pharmacy college library.—A. G. D.

The Chemistry of Organic Compounds, by JAMES BRYANT CONANT, rev. by MAX TISHLER. x + 658 pages, $5^1/_2$ x $8^3/_8$. New York: Macmillan, 1939. Price, $4.00.

This edition of the book has been revised by Max Tishler of Merck and Company. The order of presentation is the same as that in the first edition and in general conforms to the plan commonly used. Some space is given to the discussion of vitamins and hormones and there is a short chapter on drugs. A chapter is devoted to the amino acids and another to the proteins. The formation of chelate rings and the structure of the guanidinium ion are some of the new subjects discussed. The volume has proved its value as a text for general courses in organic chemistry and is recommended to pharmacists who desire to become acquainted with the newer theories in organic chemistry.—A. G. D.

Quantitative Biological Spectrometry, by ELMER S. MILLER. iii + 213 pages, $8^1/_4$ x $10^3/_4$, "Mimeoprinted." Minneapolis: Burgess Publ. Co., 1939. Price, $3.50.

This laboratory manual has been developed for the course in applied spectroscopy at the University of Minnesota. A description is given of the instruments used in spectroscopy, their principles of operation and of methods used. Various applications of spectroscopic methods are described, such as: the demonstration of chemical constitution, identification of hemoglobin and other pigments, vitamins, etc.; determination of lipids. The chapter on vitamins should be of special interest to pharmacists.—A. G. D.

Standard Chemical and Technical Dictionary, by H. BENNETT. xlii + 638 pages, 6 x 9. New York: Chemical Publishing Company, Inc., 1939. Price, $10.00.

This dictionary is stated to contain 25,000 definitions in addition to organic names, prefixes, symbols, etc. The definitions are concise, perhaps too concise in some instances, and some of the new drugs such as sulfanilamide and sulfapyridine are not included. The apothecaries' symbols, which are given in the appendix, are incorrect in part and give evidence of having been carelessly assembled. In spite of these deficiencies, the dictionary should be of value to pharmacists as a source of information.—A. G. D.