BOTANICAL STANDARDISATION OF FUMARIA PARVIFLORA LAMK.

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Introduction

Fumaria parviflora Lamk. (Fumariaceae) occurs in tropical and warm temperature regions of the world. It is widely distributed throughout Indo-Pakistan sub-continent. This plant which is known as "Shatra" in the indigenous system of medicine is much valued as diuretic, diaphoretic and antipyretic. [1] It is also used as blood purifier and in the skin diseases.

In view of its extensive use and non-availability of pure drug it was considered worth-while to standardise the drug botanically and to study the macroscopic and microscopic characters of stem and root.

Botanical Description

Fumaria parviflora Lamk. (Fig. 1) is a much branched annual herb, slender, pale green, 15-32 mm. high, erect to sometimes suberect; branches herbaceous, more or less angular, 2-3 mm. in diameter; leaves pale green, 3.8-7.7 mm. long, upto 3.8 mm. broad, glabrous, petiolate, asymetrical, ovate, deeply partite; leaflets 5-7 mm. long, 2-4 mm. broad, spathulate, dichotomously pinnate; pinules, linear 2-3 mm. long, upto 1 mm. broad; inflorescence a dense raceme, upto 2.5 mm. long; flower bractiate, bracts simple, lanceolate, scarous at the upper half, 2 mm. long and 1 mm. broad, acuminate, whitish or pink; calyx 2 mm. minute; corolla 5 mm. long; petals 4, dissimilar, upper lightly spured, lower linear, green at the tip, 2 lateral petals purple at the tips; fruit, globose, rugose when dried.

Fig. 1.—*Fumaria Parviflora*, Lamk.

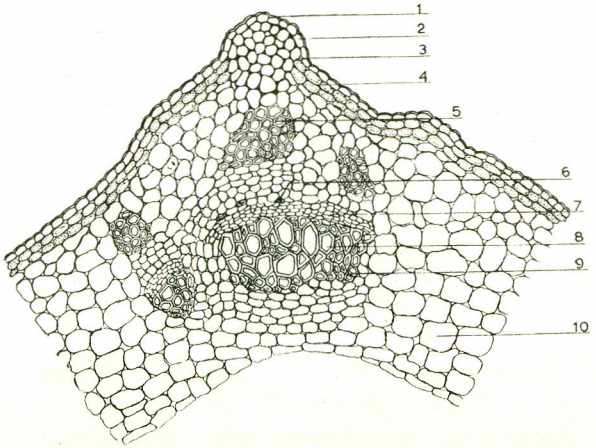
Material and Methods

The material used in the present study was collected from the experimental farm of North Regional Laboratories. The material was identified with the help of different available floras. [2,3] Pieces of stems and roots were fixed in F.A.A. for microtome sectioning. The material was then dehydrated by normal butyl and ethyl alcohol and the paraffin embedding was done according to Zirkle's method.[4] The sections were stained with safranin and fast green; Jaffery's method was adopted for maceration of the material. Hand sections of the fresh material were cut for the various microchemical test as given by Johansen and E. Gurr, [5,6] The uniform powdered material was obtained by shifting it through a No. 80 mesh sieve and studied after clearing in chloralhydrate. Cells measurements were recorded through out this work.

Description of the Stem

Macroscopic Characters.—The stem is green, angular and its diameter varies from 2-3 mm. In a transverse section it has more or less a pentagonal shape. The young stems are solid, becoming hollow when they grow older. The odour of stem is not distinctive. The taste is saline and somewhat unpleasant.

Microscopic Characters.—The stem is surrounded by a single layer of epidermis (Fig. 2). The epidermal cells are cuticularized and rectangular in shape. These cells measure 71-97 (-114) μ in length and 57-61 (-71)μ in breadth. The epidermis is followed by two layers of chlorenchy-



1 · CUTICLE; 2 · EPIDERMIS; 3 · COLLENCHYMA; 4 · CHLORENCHYMA; 5 · SCLERENCHYMA; 6 · LATICIFER; 7 · PHLOEM; 8 · METAXYLEM; 9 · PROTOXYLEM; 10 · CORTEX.

Fig. 2.—T.S. of Stem of *Fumaria parviflora*, Lamk. (x 80).

matous cells, which are interrupted under the ridges by a group of collenchymatous cells. Cortex is composed of simple parenchymatous cells measuring 71-74 (-85)μ in length and 42-55 (-64)μ in breadth. In the cortical region above the vascular bundles are found scattered groups of sclerenchymatous cells. Non-articulated laticifers are irregularly scattered in the cortex. The colour of the latex is dirty white and the nature of the contents of these cells is uncertain.[7] Collateral vascular bundles are composed of phloem and xylem.

The phloem consists of sieve tubes companion cells and phloem parenchyma. Sieve tubes measure about 88-101 (-150)μ in length and 28.6-37(-42.9)μ in breadth. The xylem is made up of vessels, tracheids, fibers and xylem parenchyma. The vessels have spiral and bordered pitted thickenings (Fig. 3). They measure about 143-471 (-800)μ in length and 28-34 (-42)μ in breadth. Tracheids are of different shapes and sizes and are found scattered in the xylem tissues. They have scalariform, pitted and spiral thickenings and measure about 400-523 (-686)μ in length and 21-34 (-42)μ in breadth. Fibers are elongated, tapering at the both ends and have longitudinally arranged bordered pits. These fibers measure 514-746 (-1001)μ in length and 14-15 (-21)μ in breadth; xylem parenchyma measures about 71-84 (-98)μ in length and 28-45 (-54)μ in breadth.

Powdered Stem.—The powdered stem is of olive green colour having saline and unpleasant taste. The odour is not distinctive. After clearing it

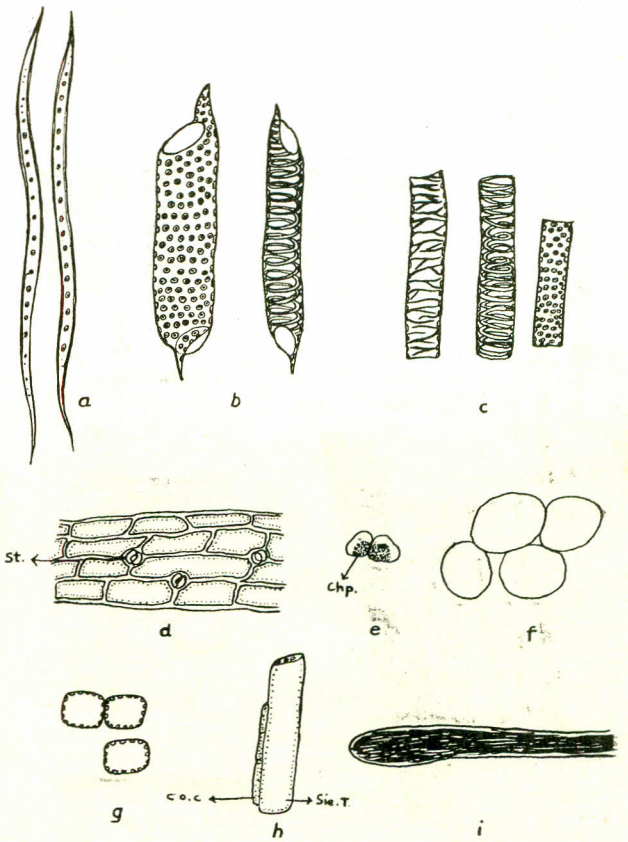


Fig. 3.—Stem Macerate of *Fumaria parviflora* Lamk. (x 80).

(a) Fibers. (b) Vessels (c) Tracheids. (d) Epidermis (e) Chlorenchymatous cells. (f) Cortical cells. (g) Xylem parenchyma (h) Sieve tube (i) Laticifer. (Chp=Chloraplast; Co. C=Companion cell; St=Stoma.

with chloralhydrate the following structures may be seen (Fig. 4).

a. Presence of complete and broken fibers.
b. Vessels.
c. Broken and complete tracheids.
d. Sieve tubes.
e. Broken pieces of epidermis.
f. Cortical cells.
g. Non-articulated laticifers.

Microchemical Tests.—Johansen D.A. and E. Gurr methods were adopted for the micro-chemical tests.[5] It was found that alkaloids are present in all the tissues of the stem, while proteins are only abundant in cortical region.

DESCRIPTION OF THE ROOT

Macroscopic Characters.—The tap root is 10-20 mm. long and 2-4 mm. thick. It is smooth,

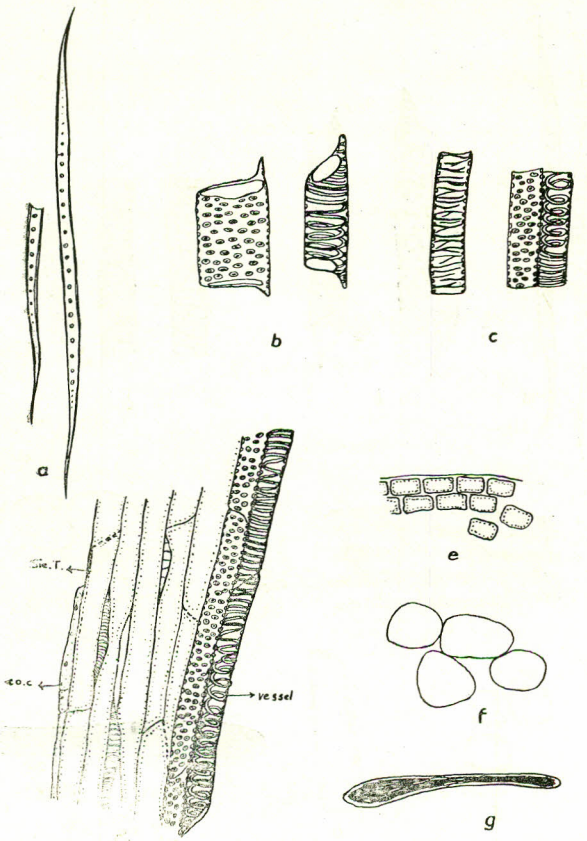
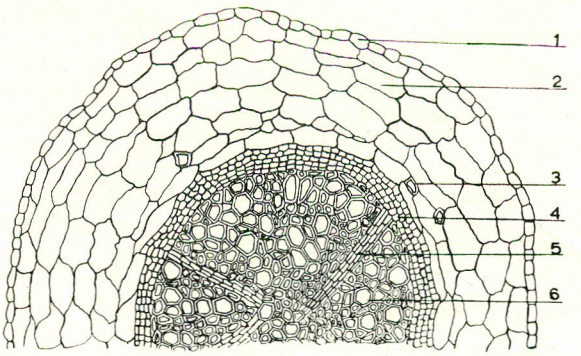


Fig. 4.—Stem Powder of *Fumaria parviflora* Lamk. (x 80). (a) Fibres. (b) Vessels. (c) Tracheids (d) Broken vascular tissues. (e) Epidermal cell (f) Cortical cells. (g) Laticifer (Co. C=Companion cell; Sie T.=Sieve Tube).

yellowish brown in colour. A transversely cut section of the root reveals an outer yellowish white cortex and brownish pale xylem.

Microscopic Characters.—The outer most covering of the root is single layered epidermis. The epidermal cells are rectangular in shape (Fig. 5). They measure 71-91 (-114)μ in length and 21-25 (-28)μ in breadth. Below the epidermis the cortical cells are thin-walled and measure 128-114 (-143)μ in length and 43-68 (-100)μ in breadth. Non-articulated laticifers are also present in cortical region. Beneath the cortex is the phloem region which is in the form of cylinder. Phloem elements are composed of sieve tubes, companion cells, phloem parenchyma, phloem rays and phloem fibers. Sieve tubes measures 57-85 (-114)μ in length and 21-34 (-57)μ in breadth. The xylem occupies about 1/2 of the entire surface area of the root in transverse section. Xylem is composed of vessels, tracheids, fibers, xylem parenchyma and medullary rays. Medullary rays are uniseriate to multiseriate and arranged alternate with xylem.



1. EPIDERMIS; 2. CORTEX; 3. LATICIFER, 4. PHLOEM, 5. MEDULLARY RAY, 6. XYLEM.

Fig. 5.—T.S. of Root of *Fumaria parviflora*, Lamk. (x 80).

The vessels are of different thickenings, shapes and sizes (Fig. 6). They are usually tapering

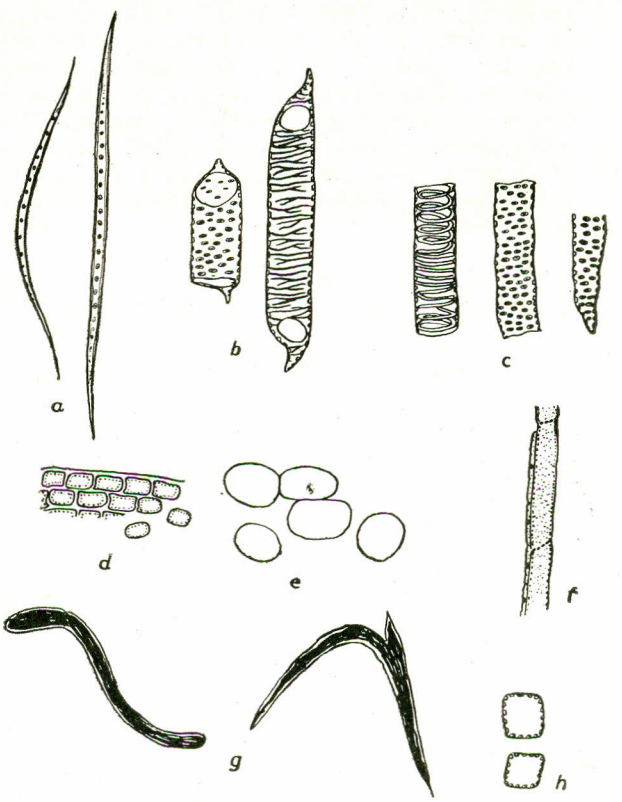


Fig. 6.—Root Macerate of *Fumaria parviflora* Lamk. (x 80). (a) Fibers (c) Vessels (c) Trachieds (d) Epiderimal cell (c) Cortical cells (f) Sieve tube (g) Laticifers (h) Xylem parenchyma.

beyond end wall perforation. These measure about 143-283 (-414)μ in length and 28-60 (-100)μ in breadth. They have bordered pits and scalariform thickenings. The tracheids also vary in shape, from tapering to blunt ends and have spiral and bordered pitted thickenings. They measure about 185-257 (-414)μ in length and 28-44 (-100)μ in breadth. Fibers are long tapering and pointed on ends. These are provided with bordered pits and measure about 171-263 (-443)μ in length and 21-25 (-28)μ in breadth. Xylem parenchyma are also present and measure about 71-97 (-114)μ in length and 28.6-45. 7 (-57)μ in breadth.

Powdered Root.—Powdered root is of brownish colour, taste unpleasant and odourless. The important structures seen under microscope are in the following (Fig. 7):

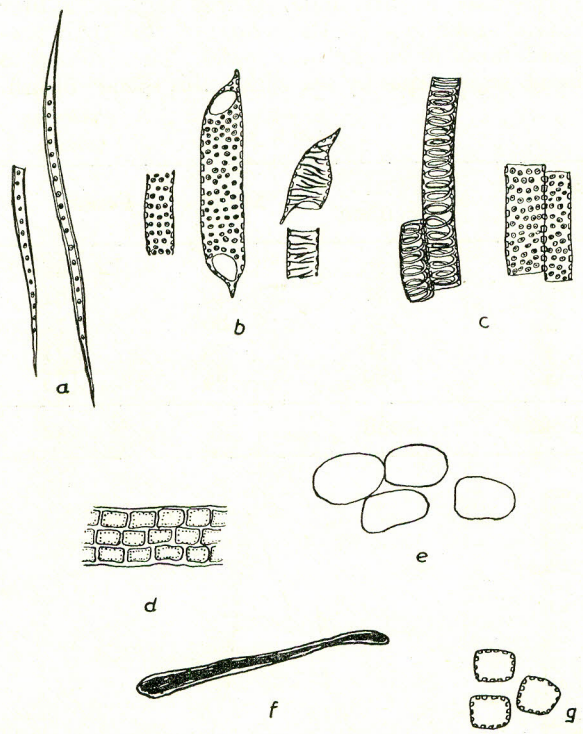


Fig. 7.—Root powder of *Fumaria parviflora* Lamk. (x 80). (a) Fibers (b) Vessels (c) Trachieds (d) Epidermal cells. (e) Cortical cell (f) Laticifer (g) Xylem parenchyma.

1. Broken epidermal cells.
2. Cortical cells.
3. Sieve tubes.
4. Broken vessels.
5. Broken and complete tracheids.
6. Fibers.
7. Xylem parenchyma.
8. Branched and unbranched non-articulated laticifers.

Microchemical Tests.—The microchemical tests[5] of the root show the presence of alkaloids and abundent amount of protein.

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References

1. R. N. Chopra, *et al.*, *Chopra's Indigenous Drugs of India* (Calcutta), 674 (1958).
2. J. D. Hooker, *The Flora of British India* (L. Reeve & Co., London, 1872), vol 1, p. 128.
3. Roger W. Butcher, *A New Illustrated British Flora* (Leonard Hill Books Limited, London, N.W. 1., 1961), vol. 1, p. 263.
4. Heber W. Youngken, *Pharmaceutical Botany* (The Blakiston Co., Philadelphia, Tronto, 1951).
5. Donald A. Johansen, *Plant Microtechnique*, (McGraw Hill Book Company, Inc. N.Y. and London, 1940).
6. Edward, Gurr *A Practical Manual of Medical and Biological Staining Techniques* (Interscience Publishers, Inc., N.Y., 1956).
7. C.R. Metcalfe and L. Chalk, *Anatomy of the Dicotyledons* (Clarendon, Press., 1957), vol. 1, p. 79.

COLOUR VARIATION: SEX RATIO AND SIZE FREQUENCY OF OTOLITHUS ARGENTEUS (CUVIER), (SILVER-BANDED JEW FISH)

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Introduction

Fishes of family Sciaenidae are very common in this region. They are comparatively cheaper and good to eat and are equally popular among the people. The objective of this study is to assess the range of size commonly caught during commercial catches. Some aspects of its biology are also dealt with here. Before this study a paper on preliminary observations of scales and otholith of *Otolithus argenteus* was published in Zerat-e-Pakistan.

Further investigations on these were continued and completed and are here considered in some greater detail. Qureshi[1-3] has recorded 13 species of family Sciaenidae from West Pakistan and in 1963 he made a detailed study on the relative abundance of different species of this family in this region. (personal communication). According to him the fishes of genus *Otolithus* are comparatively smaller in size but are quite abundant. Fishes of genus *Pseudosciaena* are comparatively larger in size but comes comparatively less in number. *Johnius* and *Sciaena* are moderately large and not very abundantly caught in this region.

Otolithus argenteus is the most common species of this region. The auther undertook the present studies during the year 1964-65. Except the above mentioned work there is no significant study on this species of fish from Pakistan. But in India Hardenberg[4] has worked on this family, Jacob and Krishna[5] also reported fishes of the family Sciaenidae from the west coast of Madras province. Venkatasubha[6] studied age determination of *Pseudosciaena dicanthus* (Lacepede) by means of scales and otolith.

Material and Method

The habits of this fish are difficult for direct observation as they are found fairly off shore water. Fishes were collected from the commercial catches as well as from "Machera" Government trawler, as soon as the nets were hauled out of the water. They were brought to the laboratory in polyethylene containers. These fishes seldom survive more than fifteen minutes outside water. In the laboratory dissection was made to study the sex and condition of gonades measurements of total length and standard length was made correct nearest to millimeter, with the help of divider and vernier scale. Colour variation was noted soon after the net was hauled out of water and after the observations it is preserved in 10% formaline. Size frequency curve was plotted.

Observations

Colour Variations.—Slight colour variations are noted in these fishes. This is a faint silvery fish with four to five very faint longitudinal bands alongside. There is a dark spot on opercle. This spot is sometimes larger and light coloured and some times small and very dark. Dorsal surface is dark. Colour becomes gradually faint and at last becomes white at the ventral surface. In some fishes there is distinct demarcation of dark silvery portion and ventral bright white portion. Below the eyes there is a portion of varied colours, in some specimen it is much faint and light. Pectoral pelvic and anal fines are orange coloured; outer edges of the dorsal fin is grayish; tips of the caudal fins are dark brown.

Sexual Dimorphism and Sex Ratio.—Male and female do not exhibit distinct sexual dimorphism. One can hardly detect it from external observations except the males are brilliantly coloured with a slim body while the females are dull and bulky. There is no marked difference in the general shape of the head between the male and female. In the present collection largest specimen is female, of 39.9 cm. in general. Female grow to a bigger size than the males.

There has always been a preponderance of female over males and the average ratio is (2:1) two females to each male. At this stage the author cannot comment on the reason of this great preponderance of female over males. There seems to be no segregation by sex within this species of fish.

TABLE 1.

Sample No.	Total specimen	Male	Female
1	130	44	86
2	131	49	82
3	252	80	172
4	256	79	177
5	259	84	175
Totals	1028	336	692

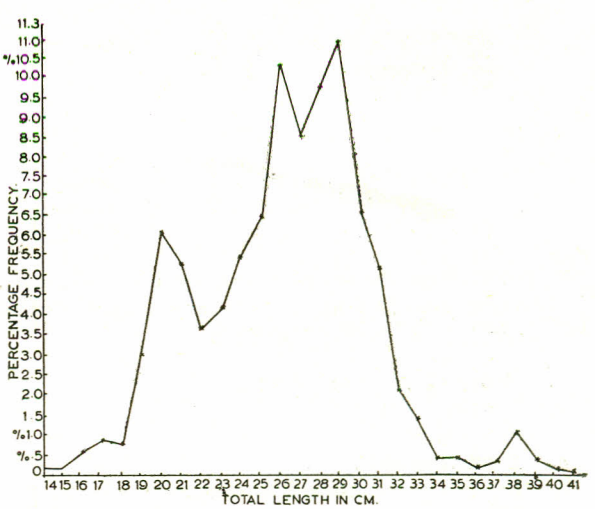

Fig. 1.—Size frequency distribution of *Otolithus argenteus* (Cuvier) in the Karachi water. (Sexes Combined.)

Size Frequency.—These observations are over 1028 fishes out of which 336 are male and 692 are females. The common size that comes in the trawlers net is from 25 cm. to 30 cm. in total length. 6.5 to 11.4% of the total catch was in the range of 25cm. to 30 cm. in length. Number of male and female are combined to plot the size frequency curve.

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References

1. M. R. Qureshi, *Family Sciaenidae and its Occurrence in Pakistan*, Proc. Pakistan Sci. Con. (1950)
2. M. R. Qureshi, *Marine Fishes of Karachi and the Coasts of Sind and Makran* (Govt. of Pakistan Press, Min. of Agri. CFD-3/1000, 1955).
3. M. R. Qureshi, *Relative Abundance of Different Species of the Family Sciaenadae in West Coast of Pakistan* (Personal communication, 1964).
4. J. D. F. Hardenberg, *The fish Fauna of the Rokan Mouth.* Trevbia, Buitenzorg., **13,** 81 (1931).
5. P. K. Jacob, and M. B. Krishna, *Sciaenids of the West Coast of Madras Province*, J. Nat. Hist. Sci. Bombay, **48,** 118 (1948).
6. R. K. Venkatasubha, *Studies on the Age Determination of Pseudosciaena diacanthus (Lacepede). by Means of Scale and Otolith*, Indian. J. Fisheries, **8,** (1961).
7. G. Seslappa, *Occurrence of Johnius lololepidotus (Lacepede) in Indian Water*, Curr. Sci., **25,** 121 (1956).
8. H. Tabe, *Breeding Habits of the Sciaenoid Fish Pseudosciaena manchurica in the Korean Seas.* Jap. J. Ichthyol, 285 (1951).

THE INFLUENCE OF CROP ON SOIL FUNGISTASIS*

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Introduction

The occurrence of factors toxic to fungi and bacteria has been reported in natural soil in different parts of the world (Jefferys and Hemming,[1] Hessayon,[2] Parks,[3] and Jackson[4,5]). Dobbs and Hinson[6] found complete inhibition of spore germination of *Penicillium frequentans* westling, *P. expansum* Link, *P. nigricans* (Bainer) Thom, *P. commune* Thom, *Cladosporium herbarum* Link ex Fr. and *Macrosporium* sp. in grassland and cultivated garden soil; this toxic factor was absent in the subsoil region. Boosalis [7] found natural soil to be fungistatic to *Helminthosporium sativum* Pam., King and Bakke.

The presence of this toxic factor is of ecological significance in growth and survival of root pathogenic organisms. The factors influencing the fungistasis have a direct impact on the root disease problem. Among others, the influence of crop on fungistasis was noted by Jackson. [5,8] Crop rotation is often practiced as one of the control measures for root diseases. Therefore, an experiment was carried out to study the influence of different crops on the soil fungistasis against *Fusarium graminearum* Schwabe, a common root rot pathogen, and *F. moniliforme* Scheldon, an associative organism in the corn root rot disease.

Materials and Methods

Soil samples were obtained from a crop sequence plot established in 1949 where strips of flax, corn, soya bean, wheat and oat are planted each year. One year these strips run east-west and the next year north-south. Each subplot was about 40 feet squares. In this type of arrangement, a subplot in each strip located diagonally in the plot would be under the same crop year after year. Three soil samples upto 15 cm. depth were collected from each of these subplots at monthly intervals from May to October. Soil samples were named after the crop held by the subplots. After air drying the soil samples were passed through a 2 mm. sieve and soils from the same subplot were throughly mixed. Fifty grams of this soil were taken in a clean and sterile Petridish and sufficient distilled water was added to bring it to 60% of water holding capacity. Three replicates from each subplot were used.

Following Jackson's [5] agar disc technique, four filter paper discs of 1 cm. sq. each were placed approximately equidistant on the top of the soil in the Petridishes. Agar discs (2% water agar) of 1.5 mm. thick and 10 mm. diameter were placed on the top of each of the filter paper discs. These were incubated overnight (12-14 hours) at room temperature to allow diffusion of the inhibitory substances from the soil into the agar discs. The surface of the agar discs was then seeded with a loopful of the fungal spores suspended in dis-

*Based on a thesis submitted to the University of Minnesota, U.S.A. in partial fulfilment of the requirements for MS. degree in 1961.

tilled water. Two of the four discs in each Petri-dish were seeded with *F. graminearum* and the other two with *F. moniliforme*. The spore suspensions were obtained from seven day old cultures grown on potato-dextrose agar medium. The final concentration of the spore suspensions was adjusted by adding distilled water so that each loopful contained 30-60 spores in high dry microscopic field. Duplicate control plates were similarly prepared with filter paper in place of soil. Standard asceptic technique was used.

Results and Discussion

The average percentage of spore germination of *F. graminearum* was much lower than that of *F. moniliforme*, *i.e.* 47 and 71 respectively (Table 1).

TABLE 1.—GERMINATION* OF SPORES OF F. GRAMINEARUM AND F. MONILIFORME IN VARIOUS MONTHS ON SOIL FROM FIVE PLOTS HAVING DIFFERENT CROPS.

F. graminearum Months	% Germination Plots					
	(Flax	Corn	soyabean	wheat	Oat	Average)
May ..	25	20	7	5	2	12
June ..	87	77	65	44	54	65
July ..	68	81	78	80	93	80
August ..	78	65	65	59	63	66
September	52	58	44	47	62	53
October ..	37	3	28	7	7	16
F. moniliforme						
May ..	81	71	76	62	57	69
June ..	83	87	89	83	90	86
July ..	74	74	78	54	62	68
August ..	24	37	59	29	24	35
September	74	82	84	88	89	83
October ..	87	80	94	87	89	87

*Average of 300 to 400 spores in each case.

(Data are calculated in percentage of control where percentage of spore germination ranged between 85-95.) This indicates that the spores of *F. graminearum* are more affected by soil fungistasis than those of *F. moniliforme*. Using Jackson's [5] terminology, *F. moniliforme* seems to be "unaffected". Similar difference in susceptibility to fungistasis was also noted by Chinn [9] who found that the spores of *Penicillium notatum* Westling, *Stachybotrys atra* Corda and a species of *Actinomycetes* germinated in presence of natural soil, while those of *Cladosporium* sp., *Trichoderma* sp., *Aspergillus* sp., *Ustilago nuda* (Jens.) Rostr and *Fusarium culmorum* (W.G. Smith) Saccardo failed to germinate in that condition.

The effect of soil fungistasis on *F. graminearum* was greatest in May when the germination of spores was only 12%. (Crops were sown in May). The average spore germination increased to 80% in July indicating non-existence of fungistasis in the soil. The crops were growing vigorously in this month. The effect of soil fungistasis was negligible in June, July and August-average spore germination being 70%. This inhibitory factor became pronounced again in September, when the percentage of spore germination dropped to 53. In this month the plants began to mature. The spore germination was greatly inhibited in October (16%) when these crops were already harvested. Thus the effect of fungistasis was more pronounced in May and October; the growing crops were absent in both the months. Dobbs, Hinson and Bywater [10] noted strong seasonal variation in fungistasis, highest being in September. They suggested that soil temperature was the influencing factor. The presence of severe fungistasis in May and October, but not in June, July and August indicated that this factor was neutralized by the root secretions of the growing plants. Indeed, Jackson [8] found that root secretions from the seedlings inactivate the fungistatic factor.

In May the inhibition of spore germination in soil from oat, wheat and soya bean plots was much higher than in soil from flax and corn plots. Similar results were also obtained in October in soil from oat, wheat and corn plots. The percentage of spore germination in soil from flax plot was comparatively high in May and October *i.e.*, 25 and 37% respectively. Jackson [5] obtained greater inhibition of spore germination of *Penicillium citrimum* Thom in soil containing corn than in soil containing legume, grass and weeds. The effect of crop on fungistasis was statistically significant at 10% level in May and October. Similar statistical significance was also obtained in June and September, but it may not be biologically important since the percentage of spore germination was high in these months.

The existence of fungistasis in soil in the beginning of the crop season would, therefore, be of advantage to the growing seedlings to escape infection. Since the soil from oat and wheat plot showed greater fungistasis, a crop rotation with either oat or wheat would be desirable wherever *F. graminearum* infestation becomes a problem.

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References

1. E. G. Jefferys and H.G. Hemming, Nature, London, **172,** 872 (1953).
2. D. G. Hessayon, Soil Sci., **75,** 395 (1953).
3. D. Parks, Trans. Brit. Mycol. Soc., **39,** 239-(1956).
4. R. M. Jackson, Nature, London, **180,** 96-(1957).
5. R. M. Jackson, J. Gen. Microbiol., **18,** 248 (1958).
6. C. G. Dobbs and W. H. Hinson, Nature, London, **172,** 197 (1953).
7. N. G. Boosalis, Phytopath., **50,** 860 (1960).
8. R. M. Jackson, *The Ecology of Soil Fungi*, (An International Symposium, Liverpool University Press, p, 1960) p, 168.
9. S. H. F. Chinn, Can. J. Bot., **31,** 718 (1953).
10. C. G. Dobbs, W. H. Hinson and Joan Bywater, *The Ecology of Soil Fungi*, (An International Symposium, Liverpool University Press, 1960), p. 130-147.

CULTIVATION OF CHRYSANTHEMUM CINERARIAEFOLIUM (TREV.) BOCC.-PYRETHRUM-AT LOW ALTITUDE

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Introduction

Chrysanthemum cinerariaefolium or pyrethrum, is a well-known commercial plant reputed for its insecticidal properties all over the world. Due to its very effective chemical contents, its cultivation has been practised on commercial scale in Japan, Kenya, Italy, Yugoslavia and America and is an important item of their export trade.

Keeping in view the fact that Pyrethrum is a valuable foreign exchange saving crop, it was considered advisable to explore some suitable places in Pakistan especially those situated on low altitudes where it could be successfully cultivated. In consequence, its cultivation was undertaken at the experimental farms of the North Regional Laboratories, Peshawar; (1608 feet) at first on a small experimental scale and later on at a semi-commercial scale. The methods adopted in this connection and the results achieved, so far, have been discussed below.

Historical Data and Chemical Aspects

During the World War II, when the supply of Pyrethrum preparations was discontinued, it was felt that the plant should be introduced into the Indo-Pakistan sub-continent. Its cultivation was, therefore, tried at Baramula and Tangmerg in Kashmir; at Murree Hills, Kulu Valley, Palampur and Kasauli in Panjab; at Parachinar in Kurram valley and at some other places in United Provinces, Bengal,[1,2] and Mysore. The experiment proved quite successful although with some variations in the active principle contents and yield of the drug, due to differences in altitude, soil and climatic conditions. It has, however, been found that an altitude of 6,000 feet represents the optimum height for the cultivation of this plant in Kashmir.[3-7] At some places, however, like Ranchi, Poona and Sind the cultivation of Pyrethrum crops were total failure.[2]

Flowers of Pyrethrum contain Pyrethrin I, Pyrethrin II, Cinerin I and Cinerin II.[8] It is a contact poison, highly toxic to insects and offers protection against a number of agricultural and horticultural pests and its preparations bear an important place in anti-malarial measures. It can be used either in the shape of powder or sprayed out in the form of liquid extracts, suspensions and emulsions. Different types of mixtures of Pyrethrum have been prepared by adding pine oil and sesamin etc. for protection against house flies and insects parasitic on livestock.[8]

In spite of the fact that a number of highly chlorinated synthetic products, notably DDT and Gammaxane, with high insecticidal properties have been commercially produced and are under use as substitutes for pyrethrum, pyrethrum from the natural sources, still enjoys its reputation and is considered less toxic to both animal and vegetable life, as compared to the synthetic insecticides.[8,2]

Material and Methods

CULTIVATION

Source of Seeds and Viability Test.—Fresh seeds were obtained from plants grown at Parachinar and sown in Petridishes on moist blotting papers at room temperature (Mean 57.4°F. to 77.4°F.)

in the month of April for a germination test. It was observed that 85% of the seeds were viable and the other 15% were sterile or dead. By repeating the experiments with the stored seeds after every three months, it was observed that the viability percentage fell with the age of the seeds, *i.e.*, one-year old seeds showed viability of 73% and two year-old 56%, whereas an average of 48% was found in the case of those of 3-year old, at the same temperature. Moreover, the germination time is also affected by the age of seeds.

Raising of Seedlings.—The seeds were sown in wooden trays of about 6 inches deep. To improve the drainage, about 2 inches were filled with pebbles and sand and the remaining 4 inches with sand, garden soil and well cured manure in 1:2:1 proportions. The seeds were sown by the broadcast method. The trays were kept under shade and watered once a day. The seeds germinated between 12-16 days.

The seedlings were raised in the month of December-January and kept in the green house to avoid frost. The seedlings attained a height of 2 inches in about one-and-a-half month. At this stage, the seedlings were transplanted in small well-ploughed nursery beds on about six inches high ridges and one foot apart, having again the composition of sand, garden soil and manure in the proportion of 1:2:1. When the seedlings attained a height of 4-5 inches, they were transplanted finally in the field. One pound of seeds are sufficient to raise about 13,000 seedlings.

Raising of Crop.—Field beds covering an area of $\frac{1}{4}$ of an acre were ploughed thoroughly and the weeds were removed. After levelling the field, 8-12″ high ridges were made at a distance of $1\frac{1}{2}$ feet, and well cured cow-dung manure was spread at the rate of 40 maunds per acre on the ridges and thoroughly mixed in the soil. It was ensured to transplant seedlings in the late after-noon or on a cloudy day in the beginning of March at a distance of $1\frac{1}{2}$ feet and then watered. In the beginning the fields were watered, twice a week, for a few weeks, thereafter, once a week, and in winter either once a fortnight or a month. The crop started flowering in the subsequent year in March and in the middle of April the fields were in full bloom. It has been observed that remanuring of the crops in the sparing of the second year helped in improving the crop. Moreover, the application of nitrogenous manure induced profuse vegetative growth, but supressed flowering. Weeding of the crops is necessary at suitable intervals especially in the months of February-March and July-August.

Weeds and Diseases.—Usually *Erigeron canadensis* Linn., *Convolvulus arvensis* Linn. *Scirpus maritimus* Linn. *Cyperus rotundus* Linn, and *Heliotropium undulatum* Vahl are the common weeds found in the Pyrethrum fields. No disease has been observed so far.

Collection, Drying and Yield

The flower heads were collected in the middle of April when the flowers were half opened or just opened. The flowers were dried by spreading them in thin layers in the sun. It took two to three days for the complete drying of the flowers, which contain a mean of 9% of moisture. It was found out that an acre could yield about 305 lb. of flowers.

The samples of flowers from the first year crop were analysed for their Pyrethrin I and Pyrethrin II content and were found to contain an average of 0.68% and 0.36%, respectively. It has also been observed that the percentage of the active principles fell with the ageing of the plant.

In view of the chemical content, the yield per acre and the facilities available in the plains for the cultivation, it can safely be assured that pyrethrum can be commercially exploited at Peshawar. Experiments on the improvement of crop are therefore, in progress and results would be communicated later on.

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References

1. S. V. Puntambekar, *Pyrethrin Contents of India Pyrethrum*, Curr. Sci. India, **12,** 232 (1943).
2. I. C. Chopra, *et al.*, *Indigenous Drugs of India*, (Basu Printing Works, Calcutta-6, 1958).
3. M. R. Fotidar, *Pyrethrum Cultivation in Kashmir* Current Sci., India, **9,** 360 (1940).
4. Anonymous, *Pyrethrum Cultivation in Kashmir* Sci. Cultr. Calcutta, 71217 (1941).
5. I. C. Chopra *et al.*, *Pyrethrum in Kashmir*, Curr. Sci. **14,** 104 (1945).
6. R. N. Chopra, *et al.*, *Cultivation of Pyrethrum in Kashmir*; Ind. Farm., **8,** 78 (1947).
7. I. C. Chopra, *et al.*, *Cultivation of Medicinal Plants in Jammu and Kashmir*, Ind. Coun. Agri. Res., New Delhi, 34-40 (1956).
8. C. B. Gradings, *Pyrethrum Flowers* (Mclanghlin Gormby Kind and Co., Minnea polis Minnesota, 1955), 2nd edition with Suppl.