

DISTRIBUTION AND MORPHOMETRY OF 11 DIFFERENT GENERA OF BASIDIOMYCETES COLLECTED FROM NATURAL FORESTS AND PLANTATIONS.

Muhammad Arif Chaudhary* and Ejaz Ahmed**

Abstract

Pakistan Forest Institute, Peshawar is maintaining the Forest Pathology Herbarium since its creation. The herbarium preserved more than 3500 specimens of Myco-pathological importance including those received from Dehradun, India. In all 175 available specimens of Agaricaceae, Russulaceae, Tricholomataceae, strophoraceae and Schizophyllaceae families of Basidiomycetes were sorted out for the purpose but 135 only are identified to their taxonomic positions while remaining 40 are awaiting generic status and even for some the distributional information about locality, host or habitat, collection date are missing. Only 66 representative well preserved specimens at the rate of at least one specimen/host/locality have been selected to study the details of their distributional and morphometric characteristics.

The results indicated that majority of the Agaricaceae (95.5%) belong to the mountain tract of Punjab (Murree), NWFP (Abbottabad, Galiat), AJK (Tara Khel) and the remaining (4.5%) from Sindh, Hyderabad forest area and collected mostly after monsoon (87%) with only 13% after winter rains. The maximum plant height of 14.5 cm and minimum of 2.5 cm are noted. While the maximum cap width of 14.0 cm and minimum of 2.5 cm are measured among its different members. The present colour shade of the specimens includes the golden brown (37.5%), brown (12.5%), light brown (12.3%), dark brown (6.3%), copper (6.3%), deep red (12.5%), pale cream (6.3%) and country cream (6.3%).

More than 66.6% members of Schizophyllaceae are recorded from the broad-leaved trees, with 23.8% from conifers and the remaining 9.6% from unidentified hosts distributed in the Himalayan tract of NWFP (27.8%), Punjab (42.6%), AJK (4.5%) and Sindh (24.8%). The majority (71.4%) members of this family are collected after the monsoon. while the remaining (28.6%) are after the winter rains. The maximum plant height of 1.3 cm and the minimum of stalks are noted amongst the family members. Where as the cap width variation is recorded from 0.3 cm to 2.2 cm. The dominating color of the specimens is clay (52.5%) followed by white and off white (30.1%), cream, pale cream and light brown (5.5% each).

* Forest Pathologist, Pakistan Forest Institute, Peshawar

** Technical Assistant, Pakistan Forest Institute, Peshawar

50% of the members of the Tricholomataceae are collected from the humus followed by 33.3% on ground and 16.6% on the broad-leaved trees distributed in the mountainous tract of the NWFP, Punjab, AJK and Baluchistan. All the specimens are collected during monsoon season. The height of the specimens varied from 3.3 cm to 21.0 cm and width of cap from 1.7 cm to 10.5 cm. The colour variation is recorded from golden brown (40%), country cream (40%) to copper (20%).

The members of Strophoraceae are mostly (66.7%) collected from the ground and the others (33.3%) are from the broad-leaved trees distributed in mountainous tract of AJK (100%, Tarar Khel). Collection time is 100% after monsoon. The maximum height of 15.7 cm and the minimum of 3.4 cm with the maximum cap width of 7.5 cm and minimum of 1.9 cm have been recorded in these specimens. The colour of the specimens is varying from golden brown (33.3%), golden, brown sheen, copper and cream (16.7% each).

More than 40% of the Russulaceae genera are found growing on the ground followed by 31.5% on conifers, 18.8% on broad-leaved and less than 6% on the unknown hosts. These are collected from the mountainous tract of AJK (62.5%), NWFP (25%) and Punjab (6.2% each). The collection season is altogether (100%) after monsoon. A great variation from less than 1.2 cm to 9.0 cm in plant height and cap width variation of less than 1.2 cm to 9.2 cm is also. A great variation of colour has been observed which includes brown (6.3%), golden brown (12.5%), sharp brown (6.3%), light black (6.3%), deep red (18.9%), light red (12.5%), beige (6.3%), pale cream (12.5%), country green (12.5%) and cream (6.3%).

Introduction .

The Basidiomycetes include the familiar larger fleshy fungi such as toadstools, bracket fungi, fairy clubs, puffballs, stink horns, earth stars, bird's nest fungi and jelly fungi. Most of these are saprophytes causing decay of litter, wood or dung and some are serious agents of wood decay (Cartwright and Findlay 1958 and Ahmad, 1992). Some of the toadstools form mycorrhizae and some are severe parasites, which destroy a wide range of woody and herbaceous plants whilst the fleshy fungi enjoy a notorious reputation for being poisonous. The majority of the toadstools are harmless and several species besides the field mushrooms are good to eat (Ramsbottom, 1953). Anis worth (1973) has grouped the basidiomycetes into three groups on the basis of the status of the basidiocarp development. These groups include: (I) Teliomycetes (II) Hymenomycetes and (III) Gastromycetes. The Hymenomycetes, the largest

group of basidiomycetes includes many of the well-known toadstools, bracket fungi, fairy clubs, jelly fungi and like. This group is sub-divided into two sub classes i.e. Phragmobasidiomycetidae and Homobasidiomycetidae on the basis of basial structure (McNabb and Talbot, 1973). Homobasidiomycetidae has been further classified into six orders. Out of these six Agaricales and Aphylophorales have holobasidia and differ from each other on the basis of their fruit bodies i.e. Agaricales are fleshy, being usually composed of thin-walled hyphae which inflate, whilst the fruit bodies of Aphylophorales are often more complex, being composed of thin-walled generative hyphae.

Traditionally all the gill bearing Hymenomycetes were placed in a single-family i.e. Agaricaceae, but the modern taxonomic treatments have resulted into 16-18 homogeneous families (Singer, 1975).

Biological Sciences Research Division, Pakistan Forest Institute, Peshawar is maintaining the Forest Pathology Herbarium since its creation. The herbarium has more than 3500 well preserved specimens of Myco-pathological importance. Most of the collection of the herbarium belongs to Basidiomycetes followed by Ascomycetes, lower fungi, phanerogamic parasites, bacteria etc. These specimens are being used not only by the forestry related students, scholars, researchers and forest field officers but also by the other interested research/teaching organizations, universities and Institutes for the purpose of demonstration, referencing and taxonomic identification. Keeping in view the importance of Basidiomycetes in forestry as Myco-pathological agent some 175 specimens of Agaricales and Aphylophorales have been selected to prepare this documentation giving brief description of host, locality, habitat, colour, size and date of collection.

Material and Methods

All the specimens of Agaricaceae, Russulaceae, Tricholomataceae, Strophoraceae, and Schizophyllaceae were sorted out from the Forest Pathology Herbarium. Out of these only one well-preserved representative sample/host/locality was selected to facilitate the morphometric work. The morphometric measurements were carried out in the Forest Pathology Laboratory. Photography of the specimens was carried out with help of PC-Camera in the studio of the Institute. The height and width measurements were carried out with the help of divider and steel ruler.

The height of the specimens was measured from the bottom to the top while the width was taken through the center of a single basidiocarp. In order to record the colour of the specimens they were compared them with the colour

chart of ICI Dulux Company. Data with regard to the host, locality and collection dates were noted from the herbarium register and labeling slips attached with the specimens.

Results and Discussion

The inventory data indicated that more than 175 specimens of 5 different families of Agaricales and Aphyllophorales orders of Basidiomycetes were collected from approximately 150 hosts distributed in natural forests and plantations. Out of these specimens 135 were clearly identified into their respective families, genera and some into species while the remaining 40 were not taxonomically grouped into genera and species. The distribution of 66 representative specimens of 11 different genera is shown in map below:

The morphometric and distributional discussion of 11 different genera belonging to 5 different families is as under:

(I) Agaricaceae

The morphometric results and distributional characteristics of its 5 different genera are as follows:

1. *Agaricus*

9 preserved specimens of this genus varied in height from 2.5 cm to 15.7 cm and width of the cap through the center ranged from 2.5 cm to 8.5 cm. The colour of these specimens ranged from cream, off white, light brown, dark brown, golden, to deep red. The hosts included broad leaf trees (*Acacia nilotica*, *quercus* sp., *Aesculus indica*, etc), conifers (*Pinus wallichiana* and *Pinus roxburghii*) and ground in different localities of the mountain tract of Punjab, NWFP and AJK. Plate 1.

2. *Lentinus*

Only three specimens of *Lentinus* were recorded on *Pinus wallichiana* and on ground in different localities of Upper Topa (Punjab), Tarar Khel (AJK) and Peshawar (NWFP). There was only 1 specimen in good conditions for measuring the length (9.5 cm) and width (5.8 cm) with country cream colour. Plate 2.

3. *Psaliota*

There were 3 specimens of this genus collected from the ground at Tarar Khel and Jungle hills which varied in height from 1.8 cm to 11.0 cm and in width from 2.5 cm to 5.0 cm. While the colour varied from copper brown to golden brown with whitish spots on the cap. Plate 3.

4. *Lapiota*

There were only 2 well preserved specimens of this genus growing one each on ground at Tarar Khel and in Jungle Hills (AJK). The length of these varied from 5.7 cm to 6.0 cm and width from 2.9 cm to 4.4 cm. They were of country cream and pale cream colour. Plate 4.

5. *Pleurotus*

There was only one specimen of this genus having 4.8 cm height and 4.3 cm width with deep red colour. It was collected from Changla Gali and Kuza Gali (NWFP) on unidentified host tree. Plate 5.

(II) *Russulaceae*

There were found two genera of this family attacking different hosts.

1. *Lactarius*

11 different specimens of this genus varied in length from 1.2 cm to 9.6 cm and in width from 1.0 cm to 9.2 cm. The colour of these specimens ranged through cream, pale cream, country cream, brown, copper, light copper, beige to golden brown/ dark brown. The hosts included broad-leaved (*Morus* sp, *Juglan regia* and *Populus* sp.), conifers (*Pinus wallichiana*) and ground in different localities of AJK. Plate 6.

2. *Russula*

All the 6 specimens of this genus ranged in height from 3.0 cm to 14.5 cm and in width from 3.4 cm to 6.2 cm. The colour of these specimens varied from light brown, light red to deep red. All the specimens were collected from the ground in different localities of Tarar Khel (AJK) and Abbottabad (NWFP) except one on jungle wood in Islamabad. Plate 7.

(III) Tricholomataceae

The following 2 genera of this family were recorded on different hosts. The distributional and morphometric results of these genera are as under:

1. Marasmius

5 preserved specimens of this genus were ranging in height from 3.3 cm to 9.0 cm and in width from 1.0 cm to 5.5 cm. The colour shades for this genus varied from copper, beige, conker and by golden brown. These specimens were collected from the humus and ground in Jungle Hills, Tarar Khel, Rawalakot (AJK) and Abbottabad (NWFP). Plate 8.

2. Collybia

Collybia was recorded on *Ficus* sp. from upper Topa and Donga Gali. The specimen was of 21.0 cm long and 10.5 cm wide having golden brown colour. Plate 9.

(IV) Strophoraceae

There were 6 preserved specimens of the genus *Hypholoma* representing this family. Their length measurements were ranging from 3.4 cm to 13.2 cm and width from 1.9 cm to 4.3 cm. Different colours recorded for this genus were copper, brown and golden. The hosts included the stumps of *Quercus* sp., *Pines* and ground in different localities of Tarar Khel (AJK). Plate 10.

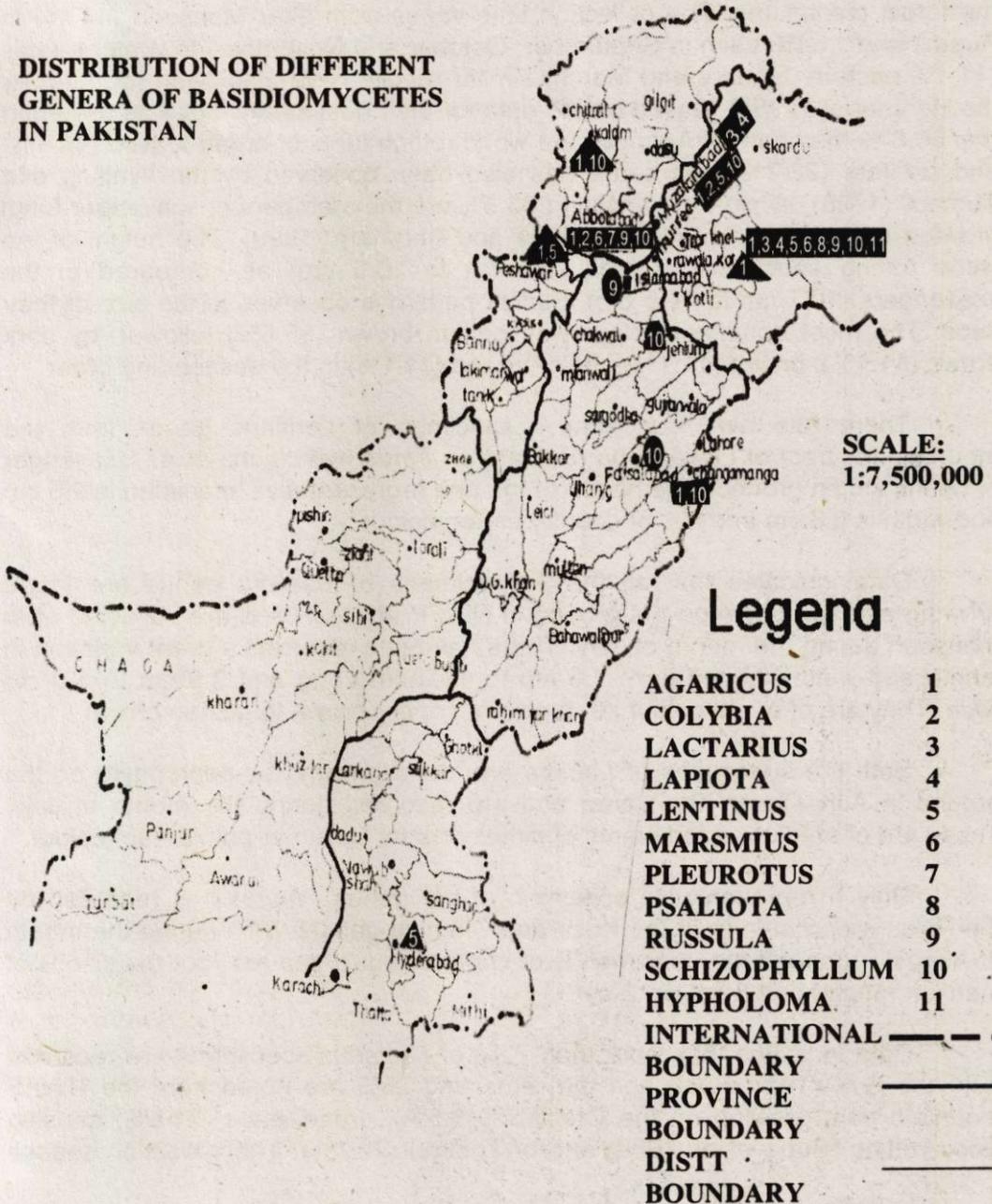
(v) Schizophyllaceae

It was one of the most important families of Aphyllophorales order of Homobasidiomycetidae. This family was selected because of its close resemblance with the Agaricales. The distributional characteristics and morphometric details of 21 different specimens of *Schizophyllum* are as under:

The height of these specimens varied from 0.2 cm to 1.5 cm and the width ranged from 0.3 cm to 2.2 cm. The colour of these specimens varied from white, off white, cream, clay and light brown. The host list for this genus included broad leaf trees (*Morus* sp., *Acacia nilotica*, *Populus* sp, *Dalbergia sissoo* and *salix* sp.), conifer trees (*Pinus roxburghii*, *Pinus wallichiana*, *Cedrus deodara*, etc.) and ground. The members of this genus were recorded from different

localities of Punjab (Changa Manga, Faisalabad, Jehlum, Sarai saleh, Ghora Gali), AJK (Tarar Khel), NWFP (Kalam, Punjar Compt. 22, shalanbo forest compt. 22, and Kalinga) and Sindh (Hyderabad). Plate 11.

DISTRIBUTION OF DIFFERENT GENERA OF BASIDIOMYCETES IN PAKISTAN



Discussion

Results indicate that majority of *Agaricus* (77.7%) have been collected from the Mountain tract (above 5000-ft height) while the others (22.3%) are from the forest plantations. The collection time varies from after Monsoon (44.4% in August and 11.1% each in September, October and November) to winter rainfall (11.1% each in January and March) similar results have also been reported by the Hong *et al.* (1984). Based on the data for their host safely it can be assumed that 66.6 % members of *Agaricus* are wood rotting fungi of broad-leaved (44.4%) and conifers (22.2%), the same has also been observed by the Walting and Turnbull (1998). While the remaining 33.3% are the members of scavenger fungi growing on the ground (Walting, 1975 and Abraham, 1993). The height of the wood rotting specimens is less (2.5 cm to 10.5 cm) as compared to the scavengers (10.7 cm to 14.5 cm). Similar pattern is observed in the size of their caps. The most dominant colour was golden brown (55.5%) followed by dark brown (11.1%), brown (11.1%) and deep red (11.1%) in the descending order.

There has been recorded 3 specimen of *Lentinus* genus from the mountainous tract of Lower topa (Punjab) on *Pinus wallichiana* or as Scavenger of debris etc on ground. The height of the one representative specimen is 9.5 cm and width is 5.8 cm and it is of country cream colour.

Data indicates that all the 3 specimens of *Psaliota* genus are found growing as saprophyte on the ground in NWFP and AJK and are collected after monsoon during the month of July. There has been recorded a great variation in length and width ranging from 1.8 cm to 11.0 cm Long and 2.5 cm to 5.0 cm wide. They are of bright colour i.e. brown or copper brown to golden brown.

Both the specimens of *Lapiota* are found growing as saprophyte on the ground in AJK (Tarar Khel) area and are recorded during the month of July. These are of medium sized plants of either country cream or pale cream colour.

Only a representative specimen of the genus *Pleurotus* is recorded on the *Pinus wallichiana* from the Kuza and Changla gali (NWFP) during the month of August. Although the specimen is of bright colour (deep red) but the size is of medium range i.e. 4.8 cm x 4.3 cm.

Data indicates that more than 72% of *Lactarius* specimens are recorded from the AJK (Tarar Khel) and the remaining 28% are noted from the NWFP mountain tract growing on the Conifers (45.5%), broad leaf (21.8%) causing wood rotting (Sung *et al.* 1989) and on ground (22.7%). The collection season

for these specimens is during the monsoon months of July (28%) and August (72%) and the same has also been reported by the Lee *et al.* (1987); Zamora-Martinez and Niet-de-Pascual (1995) and Dadwal *et al.* (1989). As for as their colour variation is concerned they are of golden brown, beige, country cream, cream, pale cream, light black, sharp brown, brown etc. on the upper surface of sporocarp. Similarly a great variation in length and width has been noted amongst the specimens which is ranging from 1.2 cm to 9.6 cm in length and in width from less than 1 cm to 9.2 cm. The texture of the Sporophore is also varying from leathery tough to foamy and brittle in nature.

It is predicted by the data that all the specimens of *Russula* has been distributed above 4000 ft height from the sea level (Islamabad, Murree, AJK and NWFP) and are recorded on ground (Abraham, 1993) except one collected on the jungle wood growing as saprophyte (Sung *et al.* 1989). Collection time for all the specimens is during monsoon (July to October) as also indicated by the Zamora-Martinez and Niet-de-pascual (1995) and Lee *et al.* (1986). The most dominating colour of the specimens is red (Light or deep) except one which is light brown. All these specimens of *Russula* are appearing as medium sized plants ranging from 3.0 cm to 7.2 cm x 3.4 cm to 6.2 cm except one (14.5 cm x 4.5 cm).

It is inferred from the results that all the *Marasmius* members have been found growing on the Himalayan Mountainous tract of more than 6000-ft height. All the specimens are found growing as scavenger on humus and stump of *Pinus wallichiana*. The members of this genus can safely be called saprophytic fungi and collected during the month of July and August. Out of the 5 specimens 4 are of medium height (3.3 cm to 9.0 cm) and Width (1 cm to 5.5 cm) whilst the 5th one has 12.4 cm height and 7.3 cm wide cap. The colour shade varied amongst the members from golden brown (40%), brown (20%), copper (20%) and Beige to country cream (20%).

The results indicate that only one specimen of *Collybia* is recorded from the Upper topa (Donga Gali) growing on *Ficus* sp. above 5000-ft height from the sea level. The species of this genus can grow as facultative parasite or saprophyte reported by the Naidenov (1980). The specimen is of golden brown color with 21.0 cm height and 10.5 cm width.

It has been inferred from the results that *Hypoloma* is distributed in *Pinus wallichiana* growing areas of AJK. More than 80.3% members are recorded as scavenger fungi and the remaining 19.7% as stem rotting fungi from *Pinus* sp (Naidenov, 1980). The maximum height of 15.7 cm was observed in one specimen followed by 13.2 cm and the rest are in the range of 3.4 to 5.0 cm.

Similar pattern of cap width ranging from 1.9 cm to 4.3 cm is noted. All the six members have different colours ranging from cooper, brown sheen, golden and golden brown.

The distribution data of the *Schizophyllum* genus predicts that 66.6% of the total specimens are collected from the Indus Irrigated plain while the remaining 33.4% are collected from the Mountainous tract of NWFP and AJK. Most of the members (75.0%) appeared to be collected after winter rains (January–May) while the remaining 25% after Monsoon (July–October). All the members of this genus can be considered as the wood rotting fungi (True, 1998 and Michaildes *et al.* 1993) causing attack on broad leave (77.0%) and conifers (23.0%). Being stalkless most of the members have the height less than 1.5 cm and width is also not more than 2.2 cm. The colour shade varied amongst the members from Milky white (19%) to off white (23.8%), clay (52.3%) and light brown (4.3%).

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Plate 1
Herbarium No.336/I
(i) *Pinus wallichiana* (ii) Tarar Khel (AJK) (iii) Nov. 1955 (vi)
H. 7.7 cm x W. 9.5 cm (v) Golden brown.

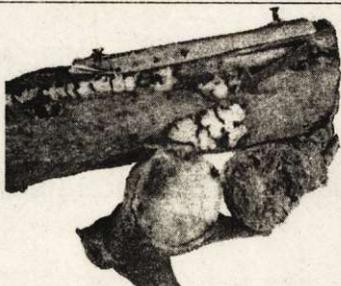


Plate 2
Herbarium No.113/ii
(i) *Morus sp.* (ii) Hyderabad (Sindh) (iii) Jan. 1954 (vi) H. 0.8 cm x W. 0.8 cm (v) Off white.



Plate 3
Herbarium No (1853) *Juglans regia* (ii) Tarar Khel (AJK) (iii) Aug. 1964 (vi) H. 9.0 cm x W. 8.7 cm (v) Upper light black lower brown.

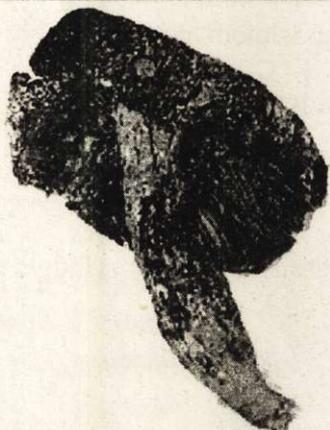


Plate 4
Herbarium No 1326
(i) Ground (ii) Tarar Khel (AJK) (iii) July 1961 (vi) H. 7.2 cm x W. 6.2 cm (v) Light red.

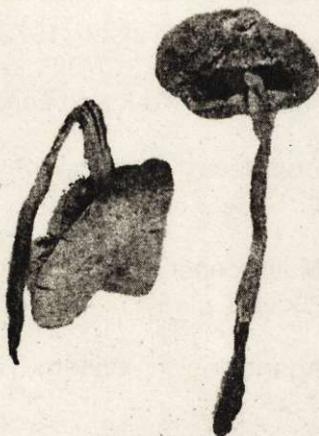


Plate 5
Herbarium No 1289 (i) Ground (ii) Jungle hills & Tarar Khel (iii) July. 1961 (vi) H. 7.8 cm x W. 4.5 cm (v) Lower brown Upper copper.



Plate 6
Herbarium No 1290 (i) Ground (ii) Jungle hills (AJK) (iii) July 1961 (vi) H. 1.8 cm x W. 2.5 cm (v) Golden brown with whitish appearance.



Plate 7
Herbarium No 546/i(i) *Ficus*
sp. (ii)Upper Topa (Donga
Gali) (iii)Jun. 1955 (vi)H. 21.0
cm x W. 10.5 cm (v) Golden
brown



Plate 8
Herbarium No 616/i(i) Not
known (ii)Tarak Khel (AJL) (iii)
July, 1965 (vi) H. 9.5 cm x W.
5.8 cm (v)Country cream



Plate 9
Herbarium No 1278(i)
Ground (ii) Tarar Khel
(AJK) (iii) July. 1961(vi) H.
5.7 cm x W. 4.4 cm (v)
Country cream with copper
shade upper surface.

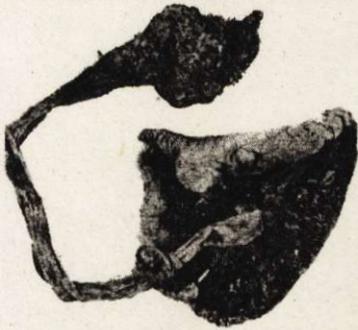


Plate 10
Herbarium No 1292
(i) Ground (ii) Tarar Khel (AJK)
(iii) July 1961(vi) H. 13.2 cm x
W. 4.3 cm (v) Golden.



Plate 11
Herbarium No 122/xi(i) *Pinus*
wallichiana (ii) Kuza Gali and
Changa Gali (NWFP) (iii)Aug.
1950 (vi)H. 4.8 cm x W. 4.3 cm