Results and Discussion

RESULTS AND DISCUSION

The study of smuts fungi is very fascinating. These fungi were extensivelly studied by many workers from the different parts of the world. The aspects of study are quite diverse. Being so prominent and highly destructive plant pathogens, these smuts produced hundreds of diseases, most systematically to the economically important crop plants, i.e. the main source of human food. Plant pathalogists as well as mycological taxonomists extensively studied them to understand their nature in respect of morphology, cytology, genetics, taxonomy, physiology, pathogenicity and even their cultural studies to know nutrition and growth under varied conditions.

Even though, a good number of smuts have been studied throughout the world, there are yet certain regions where these fungi are still awaiting to be explored for the further systematic study.

The State of Maharashtra, especially the Western Ghats, is known for its diverse flora of fungi. This has been justified well when certain visits were made in different seasons which provided a large number of smuts, known and unknown. The area selected for the present work is the South Western part of the Maharashtra State, especially the Ghat

region which is very rich mycologically. Large number of collections of the smuts were made in the different seasons repeatedly for many years from different localities. These collections were brought to the laboratory and were studied together with the previous collections made by this mycological school.

In the present investigation, Order Ustilaginales from the Class Teliomycetes has been studied. This Order has two families viz. Ustilaginaceae and Tilletiaceae.

The present study includes the taxonomic account of nine genera and 32 species, out of which three species are new to India, 11 species are new to Maharashtra and 8 species described as new taxa. Out of the remaining 10 species, 6 species are considered as Comb. nov., one as synonym and the three as having new additional host. The importance of morphology and the host specialization were taken into consideration for species delimitation. However, germination in two species has also been worked out.

From the family Ustilaginaceae, five genera have been studied in detail which are, *Cintractia, Farysia, Sorosporium, Sporisorium* and *Ustilago*. These genera are represented by 25 taxa and are restricted to the members of the families Cyperaceae, Polygonaceae and Poaceae. Out of the five genera from Ustilaginaceae *Ustilago, Sorosporium* and *Sporisorium*

were found to be confined to the hosts of the Poaceae, i.e. these were graminicolous.

The genus *Sporisorium*, which has been reinstituted, has been accepted. It has a peculiar character, i.e. having partitioned cells in chains or groups. A new species viz. *Sporisorium pseudanthistriae* sp. nov. has been proposed here as it was collected on *Pseadanthistria hispida* Hook., and remaining six species, which show the partitioned cells in group or chains, have been proposed as new combinations tentatively because original materials have not been studied due to non-availability. Two species viz. *Sporisorium holci-sorghi* (Revolta) Vanky and *Sporisorium neglectum* (Niessl) Vanky reported as new to India.

In the present study, the genus *Ustilago* was found to be dominant and represented by its eight species, in which one is a new species collected on *Eleusine brevifolia* Wild. as *Ustilago brefifoliae* sp. nova. *U. montagnei* Tul. var. *major* Desm. has been reported first time from India. Other five species of *Ustilago* which have been studied in the present investigation are new to the State.

The only species *U. utriculosa* was collected on *Polygonum serrulatum* Lag. as a new additional host.

The genus *Sorosporium* Rudol. is another dominant genus. It is one of the commonest genera in Maharashtra. It is

represented by its six species attacking the only family Poaceae. The genus is characterised by the spore balls wherein the outer spores are usually thick-walled, smooth to minutely sculptured and smaller in diameter, while the inner spores are comparatively thin-walled. The infection is mostly restricted to the inflorescence. The species viz. *Sorosporium andropogonicola* and *S. spirocolumellae* are described as new species on the basis of morphology. Three species are described for the first time from Maharashtra State and one species on the new host.

The spores of *Cintractia* are comparatively larger in size as compared to the spores of *Sporisorium, Ustilago* and *Sorosporium*. The host species *Cyperus carymbosus* on which the species of *Cintractia* occurred is described as a new additional host from Maharashtra State.

Farysia butleri (Syd.) Syd. is the only species described first time from the State of Maharashtra on *Scleria stoksiana* Boeck.

In the present work family Tilletiaceae is also studied, which is represented by four genera viz. *Tilletia* Tul., *Melanotaenium* de Bary, *Urocystis* Rabenhorst ex Fuckel and *Doassansia* Cornu.

The genus *Tilletia* is represented here by four species, out of which two are new to science and two are new record for

the State. In *Tilletia sehimae* sp. nov. only one carpel in the inflorescence of *Sehima* gets affected developing hypertrophy, and sorus remained unopened. *Tilletia spodiopogonae* is another new species. These species are proposed as new species on the basis of their morphological difference and host specificity.

The genus *Doassansia* Cornu in this part of the country, is restricted to the family Acanthaceae. *D. khandalensis* a new species reported by Patil and Gandhe (1975) is being considered here as a synonym to *D. hygrophillae* because of its morphological similarities with minor variation and collected on the different species of the same host genus, *Hygrophilla*.

The genus *Melanotaenium* de Bary is represented by only one species viz. *M. eragrostidis* as a new taxon, which shows inconspicuous sori, restricted to the vegetative parts only.

The genus *Urocystis* is also represented by only one species *U. curculigoidis* as new species.

Spore germination is the fundamental and important criterion in the classification of smut fungi. Hence, teliospore germination is important. The germination of two species has been worked out. The germination of *Sporisorium holci-sorghi* (Revolta) Vanky is *Ustilago* type which forms the septate promycelium with lateral and terminal sporidia.

Normally four sporidia are devoloped in *S. holci-sorghi*. Sometimes instead of formation of basidiospores only infection hyphae may be produced.

Tilletia transvaalensis Tul. showed various types of the mode of germination. The promycelium may be of various length and may bifurcate, forming terminal cluster of sporidia. Normally four to eight sporidia are devoloped but sometimes more sporidia have been observed. More than twenty spordia are also devoloped, which are Y-shaped. The primary sporidia do not fuse *in situ* or after separation.

The statistical summary of the species of the smuts, studied in the present investigation is given in the form of a Table.

The old cliche that family timepiece is better than none and the best cannot be expected to run true, is also applicable to the taxonomic work . This piece of work is taxonomical and thus, a taxon receives fundamental importance, especially a species. There are diversity of opinion-that what constitute a spceies?, criteria for its recognition, which individual collection or taxa deserve the rank?, what range as variations occur?, how it differs from the type (Holotype) species? etc , because in determining the basic morphology of any species, the type (when available) was relied upon. However, eventhough, recognizing the many advantages of the type concept, a type, by virtue of being a

single specimen, can not provide knowledge of the natural variations that exist within a species. Therefore, the type need not be, and often is not, "typical" of the species (Duran and Fischer, 1961).

One of the aims of this study was to study the occurrence, distribution, identifying the recognized morphologic species, their host range and related devlant forms (i.e. range of variations). Because the morphological characters in the smut fungi, available to taxonomists, are comparatively limited and thus, it is difficult to delimit a taxon or to find out distinctive features of a taxon (= species) is rather difficult or challenging and thus, many taxa have their specific epithetes names of their hosts (Anisworth, 1968). The identification procedure of an individual varies from person to person depending upon the important taxonomic characters taken into consideration which is purely a judgement of a taxonomist. This has created a lot of confusion in the field of taxonomy, not only of the fungi but also of other group of the plant kingdom.

Taking the example of this group, i.e. smut fungi, in which there is no certainty regarding number of families-which varies from two to five and finally one, from 1847 to 1985. The same is also true for the number of genera. About hundred generic names are available for smut fungi but today all are not considered valid. Duran (1971) has accepted and

key out 35 genera in total belonging to two families approximately equal to each, but this number has been increased to 50 (Vanky, 1985, 1987).

Changes in generic names, particularly well established ones, are a nuisance. A mycologist's taxonomic judgement will be more respected if he attempts to conserve well established generic names rather than to introduce large number which are not familiar and based on sound characters (Hawksworth, 1980). Because the function of a genus as group species into what are clearly homogeneous units based on a few carefully selected characters, for example, reinstitution of *Sporisorium*, a sound genus of pathological importance was forgotten for more than a hundred years.

This is also equally true at a species level as commented by Duran and Fischer (1961) as to what constitutes a species criteria for recognition, which individual, the rank etc. are abstract matters and difficult to reconcile to everyone's satisfaction. They further stated that the ideal way to errect species is via objective means. Unfortunately this is not possible or practical. More than 4000 species epithets are known in smut fungi parasitizing approximately the same number of the host plants, out of which 1000 are considered as good species and remaining are as synonyms (Vanky, 1985) distributed over more than seventy five host families of flowering plants and a few lower vascular

plants. It is well recognized and accepted the role of hosts in smut systematics but at what level?, at species, genus or family level of the host? Nobody is competent to answer such questions because that requires extensive field observations, host range studies, variation of the taxa, cross inoculation experiment - a lengthy, time consuming but reliable test to decide the host range and specificity of the fungus (here smut species).