

Problems in legislating against abuse of hallucinogenic fungi in Australia

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Introduction

The ingestion of fungi for the purpose of inducing hallucinations and other "mystical" experiences is not a new phenomenon, but has been practised in primitive societies for thousands of years. According to Heim and Wasson (1958), Southern Mexican Indians have used at least 20 different species of mushrooms in their religious ceremonies, the most important fungal species involved being *Psilocybe mexicana* (Heim), although members of the *Conocybe*, *Panaeolus* and *Stropharia* genera have also been employed.

In Siberia the fly agaric mushroom *Amanita muscaria* is ingested as an inebriant by peasants who use it as an adjunct to their religious ceremonies (Schultes, 1969) and who look with disfavour upon excessive use of these mushrooms.

Although the Australian aborigines did have knowledge of a number of native plants containing pharmacologically-active material, there is apparently no evidence available to suggest that they ingested Australian fungi to induce hallucinations.

In the past few years increased interest has been shown overseas by drug abusers in psycho-active agents of natural origin such as psilocybin and psilocin which are known to occur in a number of fungal species. The drug mescaline which is present in the peyote cactus *Lophophora williamsii* is also highly regarded. In Australia drug abusers are now known to search for locally growing fungal species which can cause hallucinations on ingestion. This paper has been prepared as an attempt to show some of the difficulties associated with the formulation of legislation designed to control the abuse of hallucinogenic fungi.

The problem

In 1972 there were more than 60 individual Australian drug abusers charged with offences concerning fungi containing psilocybin or psilocin, although, as will be shown later, some of these charges were laid on the basis that fungal species found in their possession were assumed to contain either one or both of these psycho-active compounds. On a number of occasions subsequent chemical analysis failed to confirm this assumption and the charges had ultimately to be withdrawn.

The formulation of drug abuse legislation and its enforcement are usually regarded as being the province of each individual Australian State or Territory, except in regard to the importation of drugs which is controlled by Commonwealth authorities. There are, in fact, at the present time nine separate enforcement agencies operating in combating illicit drug traffic in Australia. As each Australian law enforcement agency is responsible for one of the nine different sets of drug legislation, the lack of uniformity within this mass of legislation has led to contradictory situations. As an example, in

some States it is an offence to be in possession of a particular drug—unless obtained on prescription—whereas the same drug can be legally acquired in other States without one.

Because of the national problem presented by the widespread growth of hallucinogenic fungi throughout Australia, the Central Crime Intelligence Bureau has, since late in 1971, been acting in a co-ordinating capacity as an identification service for fungal specimens sent to the Bureau by State Police Drug Squads. Fungal samples originating from Queensland, the Northern Territory, South Australia, Victoria and Tasmania have been received by the Bureau for examination by experts.

In 1972 the Tasmania Police Drug Squad forwarded several freeze-dried mushroom samples in excellent condition for identification and analysis; some were ultimately identified as being of the species *Psilocybe collybioides*. This mushroom species had apparently not been previously identified in Australia. Chemical analysis revealed the presence of significant quantities of the hallucinogenic drug psilocybin within these mushrooms. Reports from the Tasmania Police Drug Squad indicate that local abusers were picking the mushrooms and, after drying and crushing them, placing the resulting fragments in gelatin capsules and retailing these capsules on the illicit market for \$6 each. The ready availability of this hallucinogenic material effectively reduced the illicit market for LSD to the point where few, if any, LSD sales were taking place in Hobart early in 1972.

As a result of the widespread abuse of these fungi, authorities have been considering what legislation could be introduced in order to provide a basis for curbing the problem. Already one abuser had been confined to hospital for a period of several weeks, during which time he suffered from recurrent "flashback" phenomena. There have been unconfirmed reports that others have had similar experiences and that the after-effects of ingestion of these mushrooms include kidney pains and stomach cramps.

The Tasmanian authorities are most concerned that the widespread occurrence of hallucinogenic fungi in that State could act as a great attraction for abusers to travel from the mainland to Tasmania. Certainly, exportation of fungi from Tasmania to the mainland is highly likely, as knowledge of suitable species becomes widespread. As is apparent from an examination of scientific literature and reports on mushroom ingestion received by the C.C.I.B., there is a wide range of fungi within Australia which could contain pharmacologically active material, capable of causing hallucinations. The problem is therefore a nation-wide one.

Possible lines of approach

In the preparation of legislation designed to restrict the illicit use of these fungi, there appear to be three lines of approach which could be taken by the authorities:

- I. The restrictions could be based on fungal types. This approach would necessitate accurate mycological classification of any relevant mushroom species occurring in Australia;
- II. The restrictions could be based on the presence of specified chemical constituents of the fungi, or contained within extracts of preparations of the fungi. The same approach could also be used to cover any hallucinogenic compounds which are normally present in specific fungi, but which have been synthesized within a laboratory. The effective prosecution of offences against legislation of this type would

have to be based on relatively sophisticated chemical analysis required to positively identify the presence of specified chemical compounds;

III. The restrictions could be based on hallucinogenic activity.

The main lines of approach will now be considered in some detail.

I. Restrictive legislation based on specified fungal types

It is known from published literature that certain members of the *Psilocybe*, *Stropharia*, *Panaeolus*, *Conocybe*, *Amanita*, *Russula*, *Schizophyllum* and *Copelandia* genera growing outside Australia contain hallucinogenic material (Singer, 1962). Whilst there are representatives of each of these genera growing in Australia, not all of those found did contain hallucinogenic material. Australian drug abusers have been known to consume mushrooms of the *Psilocybe*, *Panaeolus*, *Amanita* and *Copelandia* genera.

Both *Psilocybe* and *Copelandia* genera occur in Australia. However reports of symptoms arising from ingestion of some Australian *Panaeolus* members are inconclusive. Further, it is possible that mixtures of different species have been taken either deliberately or inadvertently; drug abusers will undoubtedly continue to experiment with a variety of fungal species in order to identify for themselves the types which can cause hallucinations on ingestion.

An examination of legislation from all Australian States has shown that only one State has prohibited a particular fungus—the Queensland Governor in Council on 8 May 1971 declared “Mushroom (*Psilocybe cubensis*)” to be a prohibited plant for the purposes of the Queensland *Health Act* 1937-1971. This declaration effectively puts *Psilocybe cubensis* under the same type of restrictions as Indian hemp (*Cannabis sativa*) and opium poppy (*Papaver somniferum* L.).

The Queensland authorities have also attempted to cover all aspects of abuse of fungi containing psilocybin or psilocin by declaring each of these substances to be dangerous drugs. In addition the following provision is to cover substances believed to be dangerous drugs:

“All substances having hallucinogenic properties structurally derived from any of the above specified substances or from methoxyphenylethylamine.

“Sources and raw materials from which any of the above specified substances may be derived.

“All preparations and admixtures containing any proportion of any of the above specified substances.”

These were stated to be bufotenine, dimethyltryptamine, lysergic acid, lysergic acid diethylamide (lysergide), psilocin, psilocybin and mescaline.

Whilst such an approach appears to be very comprehensive, a charge preferred on the basis of fungal type would raise some fundamental problems, particularly as drug abusers are known to send to each other different sorts of fungi through the mail. And mail frequently crosses state borders. Thus, if a Queensland drug abuser were charged with possession of the mushroom *Psilocybe cubensis* and in his defence he could prove it to be *Psilocybe subaeruginosa*, the charge would probably be dismissed, unless the police had also had the specimen analysed and shown to contain either psilocybin or psilocin.

The problems associated with a fungal identification approach may be summarized thus:

- (i) The exact mycological classification of fungal species can be a very difficult and exacting task which requires a very high degree of specialized training on the part of the examiner. There are very few specialists in Australia capable of making the necessary classifications. As not every member within the particular genera described in the beginning of this section would contain hallucinogenic material, it would be necessary for any classification to be exacting. This could prove difficult as some species appear in quite different forms during their life cycles.
- (ii) A further difficulty of the fungal identification approach is one of specificity of names, as there are a number of recognized classification systems which have been developed by different authorities, such as Singer, who is a recognized authority on hallucinogenic fungi. For the sake of completeness, the name of any species should include the name of the authority who first prepared a "Latin diagnosis" for the specimen. Thus, a specimen referred to as *Psilocybe collybiodes* (Singer) would have been classified according to Singer's description of that species. For any identification of a species to be regarded as "valid", a "Latin diagnosis" has to be prepared for it and published in an international journal. It is interesting to note that although the name *Psilocybe collybiodes* has been accepted and used for the past 70 years, its "Latin diagnosis" was not published until 1958 by Singer.
- (iii) If this approach were to be used, an undescribed species would cause considerable difficulty as it would not be listed specifically within the Schedule.
- (iv) The later identification of hallucinogenic species not previously included within the Schedule would necessitate an addition to the Schedule.
- (v) As a result of the age of the mushroom, environmental factors during and after growth, and possible metabolic destruction within the mushroom, it might not contain hallucinogenic material on examination, although this material could have been present when the mushroom was picked.
- (vi) Further research is needed to establish which Australian fungi contain hallucinogenic material. Some problems could ensue if subsequent investigation would show that some of the mushrooms listed in the Schedule did not, in fact, contain such material.
- (vii) Some provision would have to be made for species already legitimately included in herbaria, etc., although this difficulty could be overcome by implementing a permit system.

II. Restrictions based on chemical constituents of fungi

At the present time, two known hallucinogens, psilocybin and psilocin, are already listed in legislation such as the Third Schedule of the Tasmanian *Dangerous Drugs Order*, 1965. They are also included in Schedule I of the international Convention on Psychotropic Substances of 1971 which, however, has not yet entered into force. Psilocybin has been found to be present in Tasmanian specimens of *Psilocybe subaeruginosa* and *Psilocybe collybiodes*, whereas both psilocybin and psilocin have been extracted from *Copelandia cyanescens* grown in the Northern Territory. Drug abusers from Queensland are also known to ingest *Psilocybe cubensis*, but the hallucinogenic compounds present have yet to be determined. It is to be expected on the basis of existing literature that psilocybin will be identified in future analyses.

The relative concentrations of psilocybin and psilocin within mushrooms could vary, as they can be inter-converted by enzymic action. The concentrations could also be influenced by the age of the specimen, its environment during growth and the methods used in preparing the mushrooms for ingestion.

It is known that there is a third compound present in *Psilocybe collybioides* mushrooms from the Margate area of Tasmania. This compound is present in trace amounts and has certain features in common with psilocybin; but it is definitely not that compound and has yet to be positively identified.

This illustrates some of the problems associated with restrictive legislation based on chemical constituents of the fungi, their preparations or extracts:

(i) Whilst the pharmacology of some of the members of the 4-hydroxytryptamine group is partially understood (psilocybin and psilocin are members of this group) there are obviously other compounds which might be present within the fungi of yet unknown chemical structure and pharmacological action. In order to positively identify the structure of this component, a large quantity of these mushrooms will have to be collected at the one time and subjected to detailed chemical analysis. Slightly different problems apply to members of the 5-hydroxytryptamine group which are known to occur in some members of the *Panaeolus* genus. 5-hydroxytryptamine (serotonin), 5-hydroxytryptophan and tryptophan have been identified as being present in considerable quantities in certain members of the *Panaeolus* genus.

The action of these drugs on ingestion is somewhat difficult to predict. The gut would be able to absorb a limited amount of 5-hydroxytryptamine, but if this mechanism were overloaded, any excess drug would be expected to enter the blood stream and could cause severe circulatory disturbances. 5-hydroxytryptamine does not pass the blood brain barrier. However, 5-hydroxytryptophan does readily cross this barrier, following which, if converted to 5-hydroxytryptamine, it could cause severe psychic disturbances. This compound might represent a significant threat to the mental health of any individual who chooses to consume it.

Further, if solutions of mushroom extract were injected intravenously, the results could be very serious, not only because of any hallucinogenic substances contained, but also because such extracts ordinarily contain substantial amounts of protein, lipids and other materials that are toxic when taken in this way. And the abusers themselves will not know what drug concentrations are present within any particular mushroom specimens and cannot therefore judge the doses. It follows therefore that in the formulation of any legislation it would be necessary to include not only 4-hydroxytryptamine and its derivatives (which include psilocybin and psilocin), but also 5-hydroxytryptamine and its derivatives.

At present, 5-hydroxytryptamine is included in the list of imports restricted by Commonwealth legislation, where it is regarded as a precursor for hallucinogen production.

(ii) In order to cover other compounds with potential pharmacological action, the presence of which could be inferred from known compounds undoubtedly present in the mushrooms, it would be necessary to increase the restrictions in two ways:

- (a) By restricting 4-hydroxytryptamine and its carboxyl-, alkyl and phosphorylated derivatives;
- (b) By attempting to actually specify all the chemical compounds known to have pharmacological activity and which might be present in fungi regarded as being hallucinogenic.

Approach (ii) (a) might be successfully challenged on the basis of uncertainty.

In terms of practicality it might be better to simply retain the restrictions on psilocybin and psilocin, as scheduled at present, and to sponsor research into identifying what other hallucinogenic compounds are present in the fungi, which then could also be listed in the Schedule. This would remove the element of uncertainty and would restrict the legislation to compounds which are known to cause hallucinations.

On this basis, it would be a fairly simple matter to establish a routine screening procedure for specified hallucinogenic compounds such as psilocin and psilocybin. Examination of dried *Psilocybe* mushrooms which have been stored at room temperature in Canberra for over 12 months has shown no apparent loss of psilocybin content.

The drawbacks of approach (ii) (b) are the following:

- (1) The lack of knowledge of what compounds are actually present in the fungi at any time;
- (2) Lack of knowledge of pharmacological activity of many of these compounds;
- (3) The possibility arising from (2) that some pharmacologically inactive compounds could be included within those classified as being restricted.

The need for research into these points is very real as the defence could justly argue that the psilocybin and psilocin present in *Psilocybe collybiodes* could have been formed after the mushrooms were picked. The biochemical pathways involved in the synthesis of these compounds have not yet been fully elucidated; but it is clear that an enzyme is present within the mushrooms which can convert psilocybin to psilocin through dephosphorylation.

Hence, in order to rebut any suggestion that these compounds were created by enzymic activity after the mushrooms were picked, it would be necessary to pick mushrooms and place them in an environment in which all enzymic activity would cease (e.g. liquid nitrogen). Subsequent analysis could thus serve to determine at what stage the compounds in question were formed in significant quantities within the mushrooms.

III. Restrictions based on hallucinogenic activity

This possibility will be considered briefly, but would be expected to be unenforceable as external evidence of hallucination is difficult to obtain. Further, it could be regarded as an extension of restrictions based on chemical constituents known to cause hallucinations. The defence could legitimately argue that the mushrooms:

- (a) Might not contain hallucinogenic material, with the onus of proof being placed on the Crown that they did contain such material; and
- (b) That if the Crown proved the presence of specific chemical agents, it would have to prove the presence of more than a specified quantity, as there would be differing threshold doses for differing individuals. This point would then come down to a difficult question of prediction of pharmacological activity within the individual charged. There is a further assumption made here, i.e. that the abuser would have consumed more than a specified quantity of mushrooms.

Altogether, this approach is not recommended as it is too open to challenge on the basis of uncertainty.

General legal questions

As discussed previously, the main problems associated with attempting to produce effective legislation controlling the use of hallucinogenic fungi are associated with either exacting, mycological identifications, or alternatively, the use of chemical analyses for identification of specific chemical compounds. In view of the small quantities of hallucinogens present, a reasonably high degree of analytical skill could be involved in positively identifying the presence of these compounds, particularly those present in small concentrations.

In formulating legislation the authorities would have to consider the question of "possession" of any prescribed chemical compounds found to be present in the fungi on analysis. If possession of the chemicals within the mushrooms were made an absolute offence, then there would not need to be any proof of *mens rea* on the part of the person in whose possession they were deemed to be.

On the other hand, the creation of an absolute offence of this nature could lead to hardship if any person inadvertently picked and retained any fungal specimen found to contain hallucinogenic material, unless the Courts applied the "reasonable mistake" principle to this situation.

It is recognized that the legal definition of "possession" in relation to these fungi involves an extremely complex area of law. This topic could well provide the basis for an entire article in which comparisons could be made between the different forms of State legislation appropriate to naturally occurring fungi and the common law provisions which have been developed.

In the present situation it is argued that if "possession" of psilocybin or psilocin were made an absolute offence, then it follows from the decision in *Werner v. Metropolitan Police Commissioner* (1968 2 W L R 1304) that possession of mushrooms containing these compounds would constitute an offence.

On the other hand, if possession of these drugs as such were not an offence, the onus of proof would be upon the Crown to show that the defendant knew, or had grounds for believing, that the mushroom contained a drug. He would thus have the necessary intent. Proof of the intent of the person charged with possession of these drugs would be critical to the Crown's case.

Conclusion

It would appear that the most effective form of legislation available to the authorities should contain the following:

- (i) A provision that possession of specific chemical compounds (which would include psilocybin, psilocin, 5-hydroxytryptophan, etc.) be made an offence;
- (ii) A provision that the possession of specific fungal types be regarded as *prima facie* evidence of possession of specific active principles;
- (iii) A provision that dealing in fungi presumed to have hallucinogenic properties—irrespective of whether this assumption is true or not—be made an offence;
- (iv) Where the word "fungi" is used, this refers, where necessary, to any preparation, or extract, derived from fungi;
- (v) For the sake of completeness, a section could be incorporated which is similar to that used as Item 92, Fourth Schedule, of the *Customs (Prohibited Imports) Regulations* in force under the *Customs Act* 1901-1968, which prohibits importation of:

"Any drug of whatever kind which is or is likely to be productive, or is capable of being converted into a substance which is or is likely to be productive, of ill effects substantially of the same character or nature as, or analogous to, those produced by morphine, cocaine or lysergide (lysergic acid diethylamide) (LSD 25)."

The use of this clause would thus cover any precursors of psilocin (3-(2-*N*,*N*-dimethylaminoethyl)4-hydroxyindole) and preparations containing this compound and, similarly, psilocybin (3-(2-dimethylaminoethyl)indol-4-yl dihydrogen phosphate). It could also be argued that the compounds of the 4-hydroxytryptamine group could conceivably be converted to their 5-hydroxy-analogues and would be thus automatically covered by this clause.

In the prosecution of persons offending against this legislation it would be necessary for the Crown either to prove, by chemical means, the presence of only one compound within the mushroom which would fall within the proscribed class of compounds or to have the fungal specimens positively identified. There would not be much difficulty in setting up a routine chemical test for screening samples for the presence of perhaps ten selected compounds, once the range of specified compounds had been determined.

If the fungal species were determined, and subsequent chemical analysis failed to reveal the presence of any of the compounds specified in provision (i), use of provision (ii) would still provide a basis for maintaining the prosecution.

It would appear that the Australian authorities could make a valuable contribution to law enforcement in the drug area by sponsoring research projects designed to elucidate the pathway involved in the natural synthesis of these compounds and their metabolism and dehydration, the presence of their relative concentrations under a variety of conditions, including natural growth, and the evaluation of the pharmacological actions of potential hallucinogens related chemically to psilocybin and psilocin which can be identified as being present in these fungi. The presence of other hallucinogenic principles of different chemical structure is already suspected. These compounds urgently require identification.

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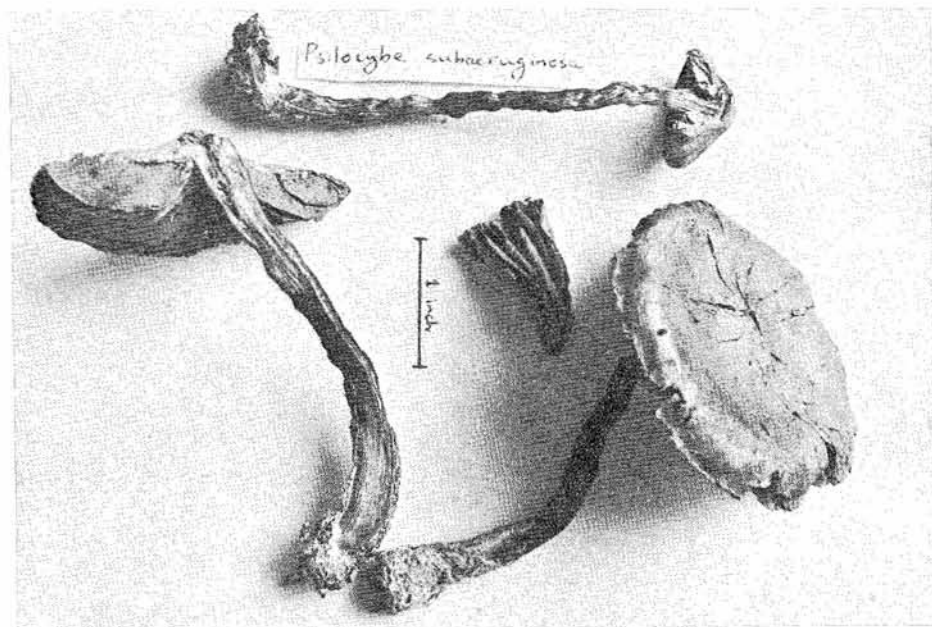
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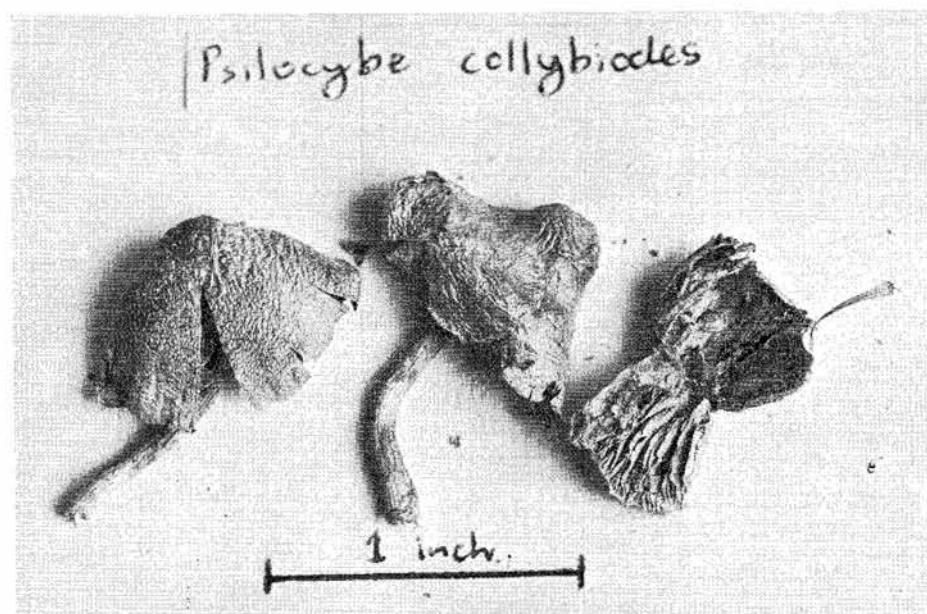
This paper is published with the approval of Mr. J. M. Davis, C.V.O., Q.P.M., Commissioner, Commonwealth Police Force, Canberra, Australia.

FIGURE 1



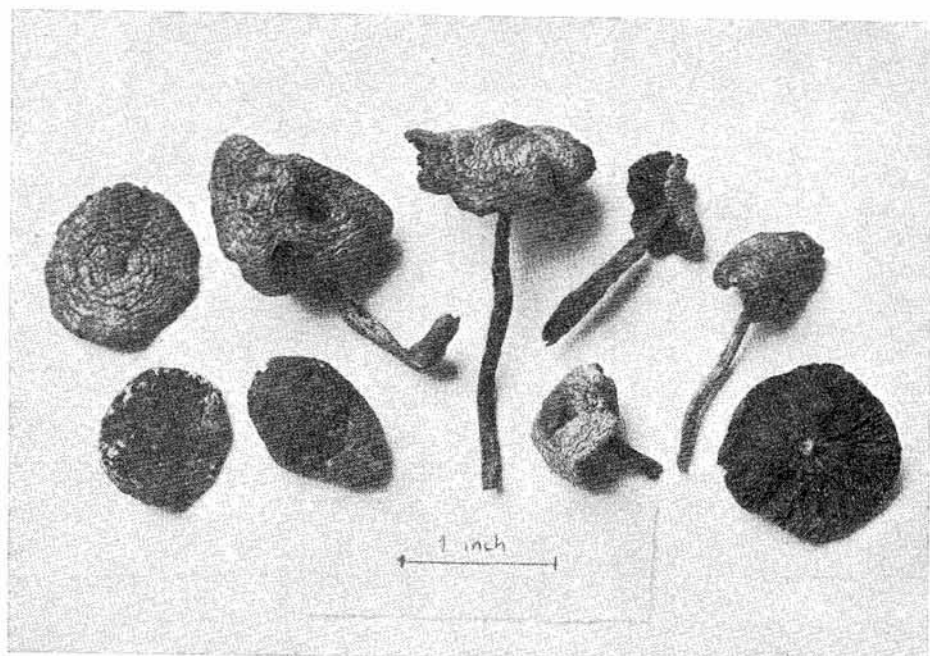
Psilocybe subaeruginosa: In Australia, this species has been found in Southern Victoria and Tasmania. Analysis has shown the presence of significant quantities of psilocybin.

FIGURE 2



Psilocybe collybioides: This species has been used by Tasmanian drug abusers. It contains psilocybin.

FIGURE 3



Psilocybe cubensis: These specimens were posted by a Queensland drug offender to a friend in the Northern Territory. Significant quantities of psilocybin were found to be present.