MUSHROOMS

THESIS FOR THE DEGREE OF M. S.
MICHIGAN STATE UNIVERSITY

LILIAN WHEELER
1899

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FOR MASTER'S DEGREE,

BY LILIAN WHEELER, B. S.

MICHIGAN AGRICULTURAL COLLEGE.

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MUSHROOMS.

The people of this country are beginning to find how very good some of the toad-stools, as they are often called, are that grow around in their door yards and in the fields and woods, often in great quantities. W. Hamilton Gibson has written a book describing some of the best and most common edible mushrooms, and also the most poisonous kinds, especially the ones that might be mistaken for edible ones. This work is filled with beautiful illustrations taken from sketches he made himself which are a great help to the ordinary mushroom - hunters who do not care to go into the scientific study of these queer plants.

The majority of people have been frightened by the many cases of death resulting from eating the poison kinds, and so have not dared to eat mushrooms at all. This has no doubt been a very safe way, but now any one who is willing to take a little trouble can in a short time become familiar with a number of the very best mushrooms that grow almost everywhere. The Department of Agriculture has published in Bulletin No. 15 an article written by Dr. Farlow, of Harvard, which was intended exactly for this purpose. He does not use scientific language, but describes each different kind very simply and so plainly no one should hesitate to use it as a guide.

The Germans have taken these mushrooms and analyzed them very thoroughly to find just what elements go to make them up, what causes the many different and vivid colors, and what the poisonous property really is, but there has been very little such work done yet in the United States. A more superficial analysis has been made, such as all the different kinds of foods have been subjected to, and it is interesting to compare the amounts of fat, nitrogen, ash, water, and carbohydrates found in each. In the Farmers' Bulletin No. 74 from Washington mushrooms are compared with potatoes, cabbage, bread and beef steak, and the experimenters come to the conclusion that mushrooms rank as rather inferior to fresh vegetables, and that in order to take the place of meat a person would have to eat on an average eight pounds a day. The Germans say, too, that from 25 to 59 % of the dry material in the mushroom is indigestible.

Although they may not be useful as a principal article of diet, no one who has ever eaten them will deny that they add much to a meal. Often they are cooked with other kinds of food for this reason. A dish of morells or fairy rings cooked until most of the large amount of water has been given off and then fried in butter until crisp would tempt any epicure.

The following table is the result of the analysis of twelve different kinds of mushrooms found on the College grounds or in the woods on the north side. They were gathered and dried during the summer of '97, and analyzed the following summer.

Results of Analysis.

	H_2O	N	Proteids	Fat	Carbo-hydrates	Fiber	Ash
Marasmius oreades (Fairy rings)	87.7	.89	5.56	.25	3.13	1.58	.89
Lepiota naucina (Smooth Lepiota)	91.4	.48	3.	.14	3.11	.65	1.22
Morchella esculenta (Morels)	88.	.78	4.87	.20	3.23	1.68	1.19
Lactarius sp. (Milk mushroom)	81.1	.64	4.	.75	8.95	3.73	1.43
Russula alutacea (Red Russula)	78.2	.77	4.81	.57	11.72	1.85	2.08
Armillaria Mellea (Honey mushroom)	90.7	.48	3.	.14	4.4	.50	.98
Clavaria Stricta (Coral ~~stricta~~)	83.7	1.08	6.75	.77	5.32	1.25	1.13
Coprinus comatus (Inky ~~comatus~~)	93.2	.38	2.37	.10	2.83	.48	.14
Pleurotus ostreatus (Oyster ~~ostreatus~~)	91.2	.47	2.94	.14	3.8	.63	.82
Lepiota procerus (Parasol ~~procerus~~)	90.2	.73	4.52	.36	2.48	.91	.80
Tremella mesenteria (Gelatin)	92.4	.12	.75	.06	6.08	.13	.48
Aminita Phalloides (Green Aminita) poison.	93.7	.27	1.68	.55	2.69	.60	.50

Results taken for comparison from Bulletin No.79.

Potatoes	75.5	.40	2.50	.10	20.	.30	1.00
Cabbage	92.5	.18	1.13	.50	.70		.70
Wheat bread	35.4	1.52	9.50	1.20	52.80		1.10
Beef steak	63.	3.	18.75	8.80			1.00

Each sample was weighed, then dried and a second weight taken, giving the per cent of H_2O. The dried mushrooms were then ground to a fine powder, and one gram was taken from each analysis and duplicates of each different kind were carried through.

The amount of N was determined first by boiling the gram of dried mushroom in a round bottomed flask with 20 c.c. of concentrated $H_2S\ O_4$ and a globule of H g. As soon as the color had faded to a light yellow the flame was removed and permanaganate of potash was gradually added until there was a permanent green color, then the whole was allowed to boil again until it became colorless. This was then washed out of the flask into a copper dish with about 200 c.c. of water, 25 c.c. of potassium sulphide, and 100 c.c. of a saturated soda solution was also added.. The steam and $N\ H_3$ that was given off when this mixture was boiled, was collected in a condenser and made to drop into a flask containing a known amount of standard $H_2S\ O_4$ colored with cochineal. After about 150 c.c. had come over, standard $N\ H_3$ is then run into the flask drop by drop until all the acid is neutralized, as shown by the purple color. Knowing how much N it must take to neutralize the standard acid in the first place and subtracting the amount you had to add gave the amount of $N\ H_3$ in the gram of mushroom from which the amount N was determined.

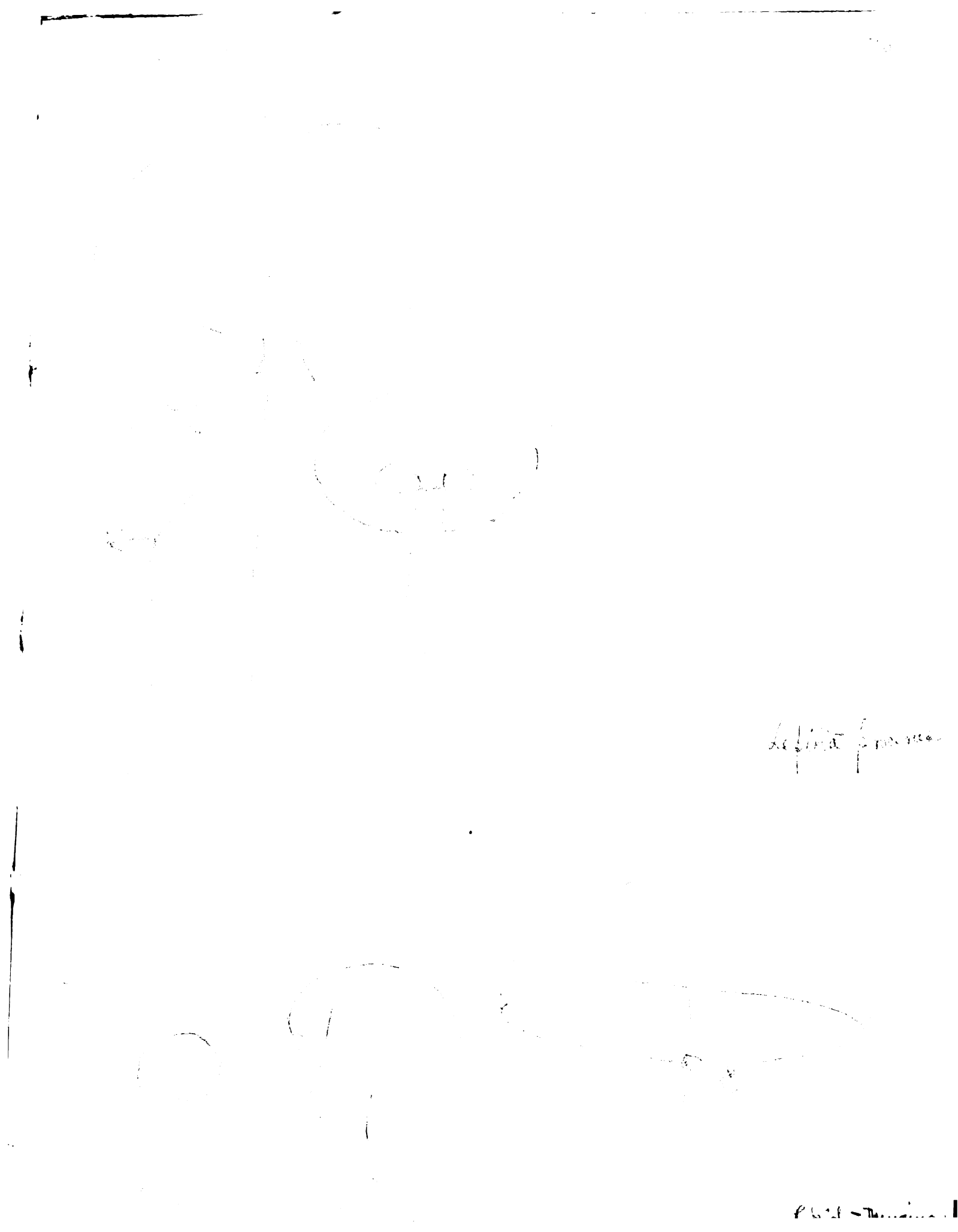
By multiplying the per cent of N by 6.25 the amount of proteid was obtained.

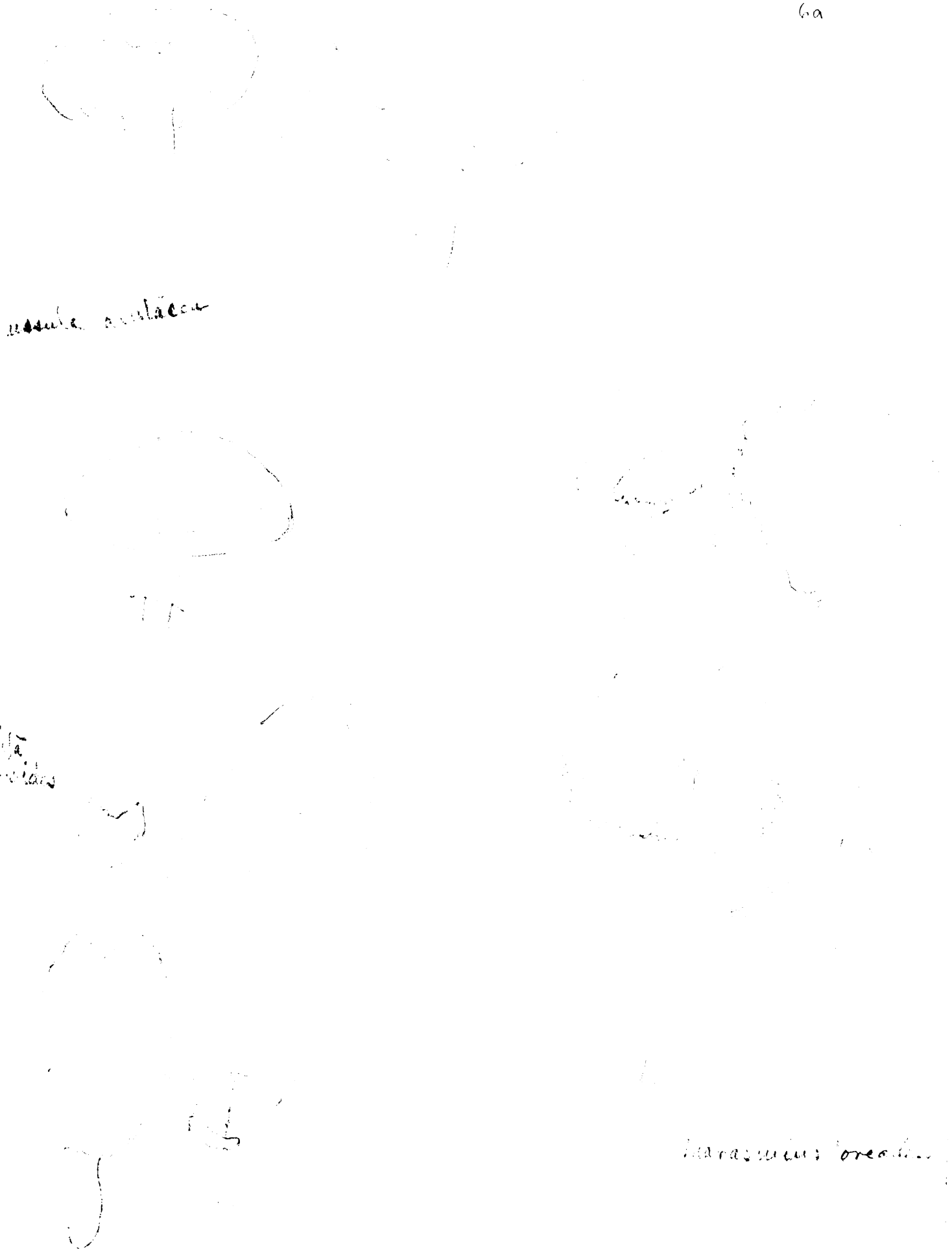
One gram of each sample was [illegible]

platinum crucible to determine the per cent of ash that was left.

To determine the amount of fat, a gram of dry mushroom was placed on a filter paper in a small porcelain pail with perforation in the bottom. This pail was hung at the end of a spiral condenser in a tube containing gasoline. This tube was surrounded by hot water kept at about the same temperature for the eight hours. This water vaporized the gasoline which was then condensed at the top of the tube by the spiral and dropped down on the powder and slowly dissolved out the fat and fell back into the bottom of the tube to be vaporized again and go through the same process for eight hours, when the fat was all supposed to have been dissolved out and be held in solution in the gasoline in the bottom of the tube. This is poured into a flask of known weight, and the gasoline evaporated. The flask is then dried, and the added weight is the amount of fat in the given sample.

The amount of crude fiber was obtained from this same sample by taking what was left after the fat was extracted and washing it into a flask with 200 c.c. of % $H_2S\ O_4$ and boiling it for thrity minutes. Then it was filtered through a linen filter and the substance left on the filter after it was washed with hot water was again washed into the same flask, this time with 200 c.c. of sodium solution and boiled for another half hour. This process digested the material and it was then filtered into a Goosh crucible and dried. It was then weighed, burned, and weighed again and the loss in weight gave the





amount of crude fiber.

The sum of the per cents of H_2O, N, proteids, fat, fiber and ash is substracted from 100%, giving the per cent of carbohydrates.

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I. Fairy-ring mushroom. (marasmius oreades Bolt.)

When these mushrooms first appear they are convex, but later they become quite flat with a mound in the center where the stem joins the cap. The texture is tough, flexible when wet but brittle when dry. The color is a redish buff or a deep cream color. The gills (underneath the cap) are broad, separate, and unequal in length. The stem is solid, tough, fibrous, naked and smooth at the base. They grow in circles in pastures and lawns. They have a nutty aromatic taste.

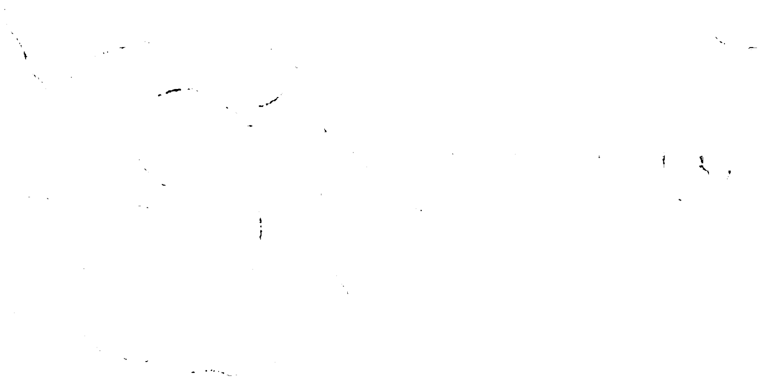
II. Short stemmed parasol mushroom (Lepiota nausina) sometimes called the smooth Lepiota.

They appear first as small white balls which later spread out into the typical shape of a mushroom, leaving a ring of the cap around the stem. When fresh and good the gills are white and also the spores. The stem is nearly hollow sometimes filled with threads and is slightly enlarged at the base. These mushrooms also grow in lawns and pastures.

III. (Morchella esculenta), commonly called morels.

They are oval, elliptical, or round in outline and hollow. They have a pale yellowish brown

Morchella esculenta



Tremella mesenterica

Clavaria stricta

[illegible]

to greenish, and the surface is honey-combed with deep depressions so that it resembles very closely a sponge. The stem is hollow and dingy white in color. They have a sweet pleasant taste. They are found in woods, orchards, and shady grassy places in May and June.

IV. Green Aminita (Aminita Phalloides) poison.

This mushroom also first appears as a ball, then expands into a parasol shape quite convex. The color is a light delicate green and the cap is smooth and viscid to touch. There is the ring or amulus here as in the lepiota, but it is wider usually. The gills are white and the stem is filled with threads like the other, but the end rests in a cup or volva which is the distinguishing mark of these poison aminitas.

V. Milky mushroom- Lactarius.

They are white in color at first, convex in form, becoming funnel shaped later. The surface is smooth and moist. The gills are white, and when broken a milky white juice exudes. The stem is hollow. They grow in woods.

VI. Red Russula (Russula alutacea).

The shape is first convex, later the rim rises above the center. The color of the top varies from a bright to a deep red, but the gills are a very decided yellow-buff color, and are equal, brittle, and broad. The stem is solid and white. The taste sweet and nut like. They grow in woods from July to September.

VII. Honey Mushroom.(Armillaria Mellea.)

a Fairy Ring

Morels

They grow in clusters, small and are round, rich yellow in color at first, expanding into a large slightly curved form when older, but keeping the yellow color. They leave a ring or annulus around the stem, which is solid and ribbed, and quite large. The gills are broad, even, and quite far apart. They grow in the woods.

VIII. Coral Mushroom. (Clavaria stricta).

This mushroom thickly branches and each branch ends with small teeth. The color is a dull light brown. It grows three to four inches high, and is found in the woods.

IX. Inky Mushroom. (Coprinus comatus).

They are egg shaped when young, becoming cylindrical and finally expand and melt away into an inky fluid. They are creamy white in color, turning black, and the surface is covered with shaggy points. The gills are crowded, equal, and white. The stem is white and hollow, with a loose cottony pith. The taste is sweet when fresh. They grow in lawns, pastures, gardens, and in rich ground, especially near barns.

X. Oyster mushroom. (Pleurotus astreatus).

They grow in clusters, and are smooth, and have a dull light yellow color, sometimes grayish. The gills are dingy white of different lengths, and they cover the stem which scarcely shows, it is so short. They are found on old tree trunks and fallen logs.

XI. Parasol mushroom. (Lepiota procexus).

They appear first as small ball like caps on a very long stem with a small protuberance at the top. Later

they expand into a large parasol. The color is cream, with dark brown spots. The gills are white, and the stem slender. They grow in woods and in grassy places.

XII. Geletin mushroom. (Tremella mesenterica).

Found on an old stump. It was a cluster of rich transparent brown jelly-like leaves all crumpled up together.

[illegible]rolus guttatus