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Mushrooms in Developing Countries

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UKRAINE

Kiev is the ancient city, it is approximately 1500 years old. When it was 500 years old and many years after, it was the central city of Kievian Rus. At that time Kiev adopted Christianity and eventually established, what is now referred to as, the Russian Orthodox Church throughout much of eastern Europe.

It would be interesting if we knew as much about when they began to eat mushrooms. We can be sure that it was quite early, long before there was much influence from central Europe. Common names for mushrooms, which grow wild in their area, do not appear to have been influenced by the west. Oyster mushrooms are now being cultivated, but they are known as "veshenka," while the word for "oyster" is "ustritza" (**Fig. 1A-C**). The general word for "mushrooms" is "grib." Many words are cognates, but for mushrooms cognates are used only for those that are exotic to them.

Two that are exotic are *Agaricus bisporus,* which they call champignon and *Lentinula edodes,* which they call shii-take have only been grown in Ukraine for a few years. Still many champignons come from Poland and China.

Veshenka cultivation is a little newer. Unfortunately, they were immediately influenced by the *Agaricus* machinery salesmen from Italy and the Netherlands. The two farms that I visited were both trying to pre-wet straw out of doors with more snow and ice than water. They were also wasting huge amounts of energy trying to pasteurize with steam. The larger operation had purchased a complete, used, Dutch line from tunnel loader to garbage-bag stuffer. The smaller had fixed a ship-container into a tunnel and had devised an interesting hydraulic-ram bag packing machine. Towards the end of my stay, I spoke to a meeting of the Association of Mushroom Growers of the Ukraine. My talk immediately followed one by a machinery saleslady from Italy, so it provided the ideal time to tell growers that the Italian and Dutch machines were good for *Agaricus* and were wasteful of energy and time for *Pleurotus.*

EGYPT

Many things in Egypt are thousands of years old; even Christianity is twice as old as it is in Kiev. However, mushrooms in all forms are relatively new to Egypt. As I rode through the Western desert in February, my driver was startled by a sudden rain squall. There were between 10 and 20 drops on our window! One night in Cairo there was a real rain, maybe 2 mm. Egypt is 100% desert. The fertile Nile valley is part of the Sahara desert as well, but through millennia, the river has provided abundant irrigation. Wild mushrooms are not unknown, but they are rare. Even *Podaxis,* a mushroom that grows wild in many deserts, could not survive in Egypt except with irrigation. I have collected *Podaxis* in Death Valley, but Egypt is much drier. Years ago, some *Agaricus* cultivation was begun in Egypt. It was primarily to provide delicacies for the tables of the imperialists. They continue to be available in supermarkets, today.

CARE and ACDI/VOCA have been using USAID and other funds to try to help Egyptian farmers (Fellahin). CARE organized the farming villages into agricultural associations. Someone got the idea to grow *Pleurotus* as a cottage industry. The Egyptian Agricultural Research Center produced the spawn and a few got started. Then, last September, ACDI/VOCA asked me to help and sent me to Egypt to begin instruction (**Fig. 2A-C**). CARE arranged to bring farmers to places where I talked to them about cultivating mushrooms. Most of the farmers were women, but men came too.

Fig. 1A-C. Mushroom cultivation and related activities in Ukraine. A: Oyster mushrooms at Gaydeyenko farm. B: Some members of the Association of Mushroom Producers of Ukraine, who attended a farce "Cheat" at a theater in Simferipol, Crimea; evening activities at Association meeting. C: Dr. A. C. Buchalo at N. G. Kholodny Institute of Botany, Kiev, after a lecture by R. H. Kurtzman.

A total of almost 300 came and showed their enthusiasm. That much enthusiasm was very interesting because it is not a food that most have any experience with. As I left, CARE and ACDI/VOCA said "you will be back in February." We agreed that in February, it would be more hands-on demonstration and less talk.

As 2006 came to an end, CNFA said they wanted me to go to Ukraine at the end of January. I had to tell them that I had already promised to go to Egypt at the beginning of February. It was not long before there was a solution, I would do both as one long trip.

February is sugar cane harvest time, so not quite as many came to my presentations in Egypt; about 200, but a few had already begun cultivating *Pleurotus* and so I was able to observe some of the problems of the beginners. Most were my students for hands-on demonstrations. In most locations we pasteurized straw one day and spawned it the next. We did not have enough materials to give everyone a spawned bag, but generally there was at least one for every village. One farmers association had obtained two steel drums and two gas burners, that would be used for pasteurization by their members.

Egypt is a very hot country, but since it is also a very dry country the wet-bulb temperature is often 10 C less than the dry-bulb, so 30 C outside, may allow the humidified growing room to be only 21 C. Of course, we generally grow at 20 C or less, but some tropical varieties will allow higher temperatures. Egypt provides more problems than some places, but they are getting started and I believe they will have a real future.

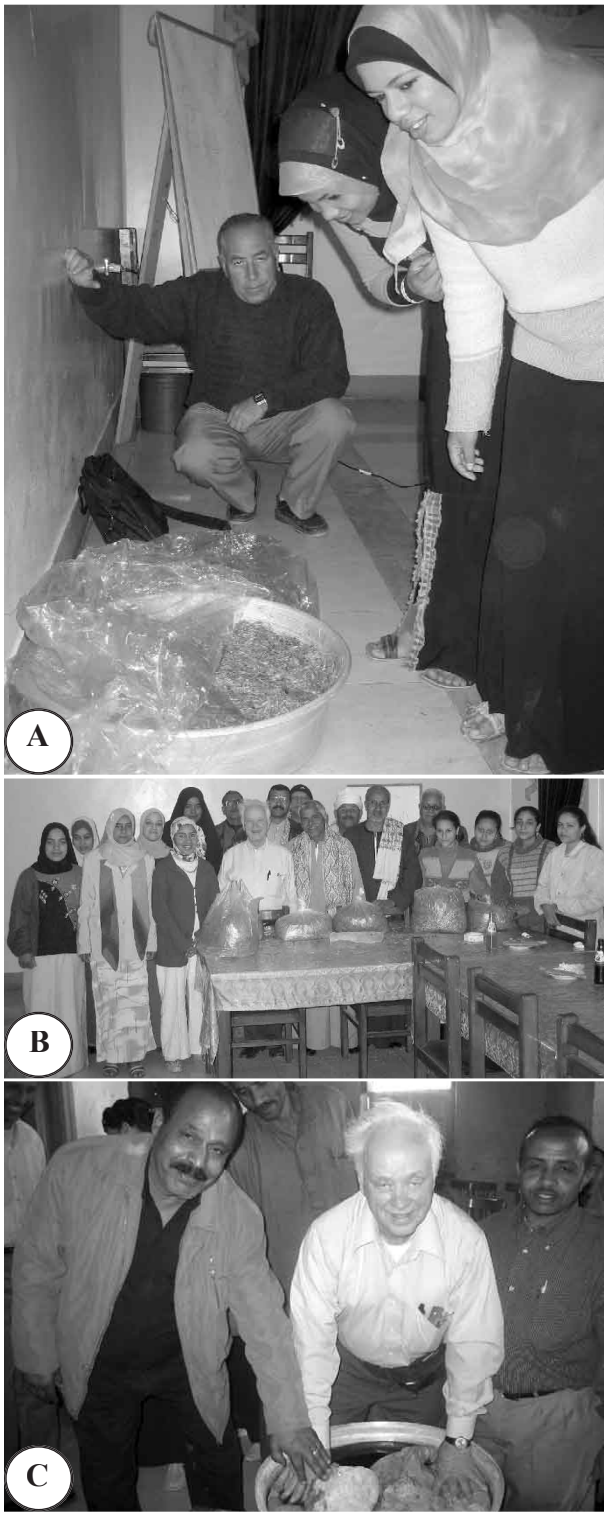

Fig. 2A-C. Mushroom cultivation and related activities in Egypt. A: Examining lose-pasteurized straw (Sohag). B: Students and R. H. Kurtzman with inoculated bags; the students took them home to grow (Sohag). C: Pasteurizing in woven-plastic bags (Luxor village).

TAJIKISTAN

While I was still finishing reports on Ukraine and Egypt, I learned that people in Tajikistan wanted help. I indicated an interest, but as soon as I started to read over the information, "alarms" went off in my head. They had heard of paddy straw mushrooms and were convinced that it was ideal for their summer climate. However, their climate is not tropical, but rather hot, arid continental. One can draw many parallels with Egypt. Little of Tajikistan is arable, but it is not quite as hot nor quite as dry as Egypt. The CIA statistics indicate that 78% of the arable land is irrigated. However, the CIA statistics indicate that 118% of the arable land in Egypt is irrigated! In Tajikistan, the water comes from snow melt in the mountains, so it is in many small fast moving rivers. Fast moving water means power, but little is captured.

The second "alarm" was that they had started growing mushrooms three years before and had grown only about 320 grams in any single year. I wondered why they had either not given up or done better.

The third "alarm" was a partial answer to the second. I learned that electric power was not at all reliable in the winter, often there is power only four hours per day. To make matters worse, their growing rooms were in a basement. I "preach" fluorescent light and against windows that make temperature control much more difficult, but if electric power is inadequate, then it will provide totally inadequate light and ventilation. At least windows and gravity can supply adequate light and ventilation. I quickly responded that there was no purpose in my going there, unless they could provide above ground space with a window and some natural ventilation. About two weeks later I got the message that adequate space had been found. My hosts were two brothers, one is a fruit farmer in Isfara, a town in the far east of the northern portion. The other was the Dean of the Faculty of Agrotechnology, of KBTUT, near Khujand. Most of my time was spent at the Faculty. Although only the Dean was located there, his niece, from Isfara, was a regular student and very interested in learning about mushroom cultivation. So, at least a member of the immediate family of the second host was with me.

On the day I arrived at the Faculty, I was shown around. Then I got the fourth "alarm;" I was shown a number of tubes and about five ca. 500 ml bottles and told that was all of the containers for cultures and spawn-making. Further they mentioned that glass bottles were very expensive for them. I knew something had to be done, if they were ever going to be able to produce enough spawn to grow mushrooms commercially. Even if they could afford it, there is no known existing source of spawn that could supply them. A few hours later, I realized that plastic soda-pop and water bottles were an abundant waste. I had never tried, but I thought perhaps they could be autoclaved. We tried an empty one and found it only very slightly deformed, but was it smaller after autoclaving? The next day we collected a few 1-½ liter plastic bottles filled them about ¾ full of cooked wheat plugged them with cotton and autoclaved them. When the autoclave was open we learned that the bottles now appeared to hold about ¾ liter, so the wheat was compacted. By slamming the bottles against hard objects we were able to loosen the wheat and dump about half into other bottles and then re-autoclave all of them. Later we started with bottles less than half full of cooked wheat and were totally successful. To those of us who can get what we need, this may seem to have been a silly stunt, but for the very poor in isolated places it was a valuable discovery.

I presented a total of 12 lectures on mushroom cultivation and about 9 laboratory-demonstrations (**Fig. 3A-C**). On my first full day we pasteurized wheat straw and cotton gin waste with water in a steel drum, heated by a wood fire. The next day we cleaned the above-ground room that they had arranged for. It was all concrete, except doors and windows. That same day, we also spawned half of the substrate with paddy straw spawn and the other half with oyster mushroom spawn that I brought with me. Media and grain preparation, inoculation and management of cultures, spawn and growing room were additional laboratory-demonstrations. The Dean's niece and her close friend plan to do their final year diploma work on cultivating mushrooms.

It is easy for those of us who are established in applied mycology to think we have all the answers. However, in *MAI* 18: 13, I mentioned wonderful new ideas that I learned, when I went to help others. When I travel, I often find people who are recently established who say they want to learn, but really want to be told that they are doing everything the correct way. Often, in the same place, one finds people who are very eager to learn, and sometimes those who learn most are the ones who ask difficult questions, or realize that being told they are doing everything right is really not as good as being told how to improve.

The most important thing for all of us is to keep an open mind. Those with no experience often are easy, because usually their minds are unconditionally open. But it is fun to be challenged with good questions from those who do listen to the answers.

Fig. 3A-C. Mushroom cultivation and related activities in Tajikistan. A: Mountains near Dushambe. B: "Too many cooks!" Students of Khujand Branch Technical University of Tajikistan (KBTUT), helping mix cotton waste-straw substrate with spawn. C: Growing room at KBTUT - just getting started.