

The Collection and Sale of Wild Mushrooms in a Community of Tlaxcala, Mexico¹

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The Collection and Sale of Wild Mushrooms in a Community of Tlaxcala, Mexico. In this paper, we characterize the harvest and sale of wild mushrooms in Javier Mina (Tlaxcala state, Mexico) based on observations made during visits to that community during the rainy seasons of 1995 and 2001. While there, we visited the forests with various families of mushroom gatherers and also carried out 16 visits to a local mushroom broker to obtain information on the buying and selling of the mushrooms, including a list of the prices per kilo of the species that are sold commercially. *Boletus* cf. *pinophilus*, *Lyophyllum* cf. *decastes*, *Hebeloma* aff. *mesophaeum* and the *Amanita caesarea* complex were the highest-priced species, and were those collected in the greatest amounts. Our observations indicate that the gathering of mushrooms, a traditional activity among the people of Javier Mina, contributes, through the sale of the mushrooms, to the income of the community during the rainy season.

Recolección y venta de hongos silvestres en una comunidad de Tlaxcala, México. Recolección y venta de hongos silvestres en una comunidad de Tlaxcala, México. El objetivo de este trabajo es describir el proceso de recolección y venta de hongos silvestres en Javier Mina, Tlaxcala. Para describir estas actividades se realizaron visitas a los bosques con varias familias recolectoras de hongos durante las épocas de lluvias de 1995 y 2001. Además, se realizaron 16 visitas a un distribuidor local para registrar información con respecto a la compra y venta de los hongos. Se obtuvo un listado de los precios por kilo de los hongos que se comercializan. *Boletus* cf. *pinophilus*, *Lyophyllum* cf. *decastes*, *Hebeloma* aff. *mesophaeum* y *Amanita caesarea* complex fueron los hongos recolectados en mayor cantidad durante este estudio, mismos que tuvieron los precios más altos de compra-venta. Se concluye que la recolección de hongos es una actividad tradicional para la gente de Javier Mina; sin embargo, la venta de éstos, contribuye a la obtención de ingresos durante la temporada de lluvias.

Key Words: Ethnomycology, wild mushrooms, Mexico, mushroom trade, La Malinche National Park, Tlaxcala.

Introduction

Many rural Mexicans gather and sell wild edible mushrooms during the rainy season, particularly those kinds that cannot be artificially propagated. More than 200 species of edible wild

mushrooms have been recorded in Mexico (Guzmán 1977; Villarreal and Pérez-Moreno 1989). Despite the commercial value of certain mushrooms and their obvious contribution to collectors' incomes (Pellicer-González et al. 2002), only a few studies have focused on the process of gathering and selling wild mushrooms in Mexico (Herrera and Guzmán 1961; Aguilar-Pascual 1988; Villarreal and Pérez-Moreno 1989; Mariaca Méndez et al. 2001; Montoya et al.

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2001; Rúan-Soto et al. 2004). This study contributes to the emerging body of literature on the sale of wild mushrooms in village economies and local markets in many parts of the world (Sommerkamp 1990; Jones et al. 1994; Sharma et al. 1997; Harsh et al. 1999; Boa 2004) by providing information on the harvest and sale of wild mushrooms in the small community of Javier Mina (Tlaxcala, Mexico). Studies such as this one can provide valuable, basic information about the kinds and quantities of mushrooms gathered, their ecology and conservation, the economic benefits their harvest provides, and their cultural importance (Pilz et al. 2001; Thadani 2001).

Methods

STUDY SITE

The village of Javier Mina was chosen for this study because a majority of its people collect and sell wild mushrooms. The village belongs to the municipality of Trinidad Sánchez Santos, in the southeastern part of the state of Tlaxcala, on the slopes of the La Malinche Volcano (Fig. 1). The village was founded in 1938 and by the year 2000 had a total of 102 families. The people are of Nahuatl ancestry but nowadays there is only one Nahuatl speaker (INEGI 2005). Their main economic activities are based on seasonal agriculture, primarily the growing of corn and beans for local sale and consumption. Most of the village families have dedicated agricultural plots ranging from one-half to four hectares in size. Plows are typically used to till the soil rather than tractors. Livestock such as sheep, cattle, and pigs are also raised and traded, but on a very small scale. The lack of economic opportunities causes most of the young adults to move to nearby cities where they take unskilled labor or domestic service jobs or engage in simple entrepreneurial activities such as selling tamales. Some of the families in the village also grow *nopal* cactus for sale, but the main economic activity, at least during the rainy season, is the collection and sale of wild mushrooms. The community is 170 kilometers (km) from Mexico City and 4 km from a forested area (National Park of La Malinche Volcano), which is dominated by pine and fir trees (*Pinus hartwegii* Lindl., *P. montezumae* Lamb., *Abies religiosa* (HBK.) Chamb & Schl.); additionally, there are alder (*Alnus jorullensis* HBK.) and some oak (*Quercus crassipes* H. & B.) trees. It is in this

forest (at altitudes of 2,800–3,600 meters [m]) that the people of Javier Mina collect wild mushrooms.

DATA COLLECTION ON MUSHROOMS

We interviewed 55 mushroom collecting families from Javier Mina in a local store that agreed to collaborate with this study. The owner of the local store is one of four mushroom dealers in Javier Mina that buy the local mushrooms and then resell them to other markets. The four mushroom dealers in Javier Mina are Nahuatl descendants and are closely related to each other: three sisters and their mother. They come from a family of former mushroom gatherers and each is now part of the local entrepreneurial shop-owning elite.

We made 20 field trips with different mushroom collectors to observe how they located and collected mushrooms. From the interviews and field trips, information was compiled on preferences for particular mushrooms, the gathering and cleaning of the mushrooms found, and their preparation for meals (Montoya et al. 2000), as well as the time required for collection and processing.

Field data were recorded for the mushrooms according to Cifuentes et al. (1986) and Halling (1996); microscopic characteristics were observed in the laboratory. Identifications were made using taxonomic literature, most importantly Romagnesi (1967), Marr and Stuntz (1973), Moser (1983), Abbot and Currah (1988), Estrada-Torres (1994), and Tulloss (1998). All voucher specimens were deposited at the herbarium of the Universidad Autónoma de Tlaxcala (TLXM).

DATA COLLECTION ON THE MUSHROOM TRADE

During the dry season, structured interviews (Alexiades 1996) were carried out with all 102 of Javier Mina's families to determine the percentage of households involved in mushroom gathering. During the rainy season, one local dealer was selected from the four in the village (all of whom are related) because she was the only one to allow researchers to observe mushroom trade activities and compile data inside her store. Researchers visited this store once a week during 1995 from late June to early October—a total of 16 times. Altogether, 55 families were interviewed during these visits, and the following information was recorded: species sold, price per kilo per species paid to the collector by the local

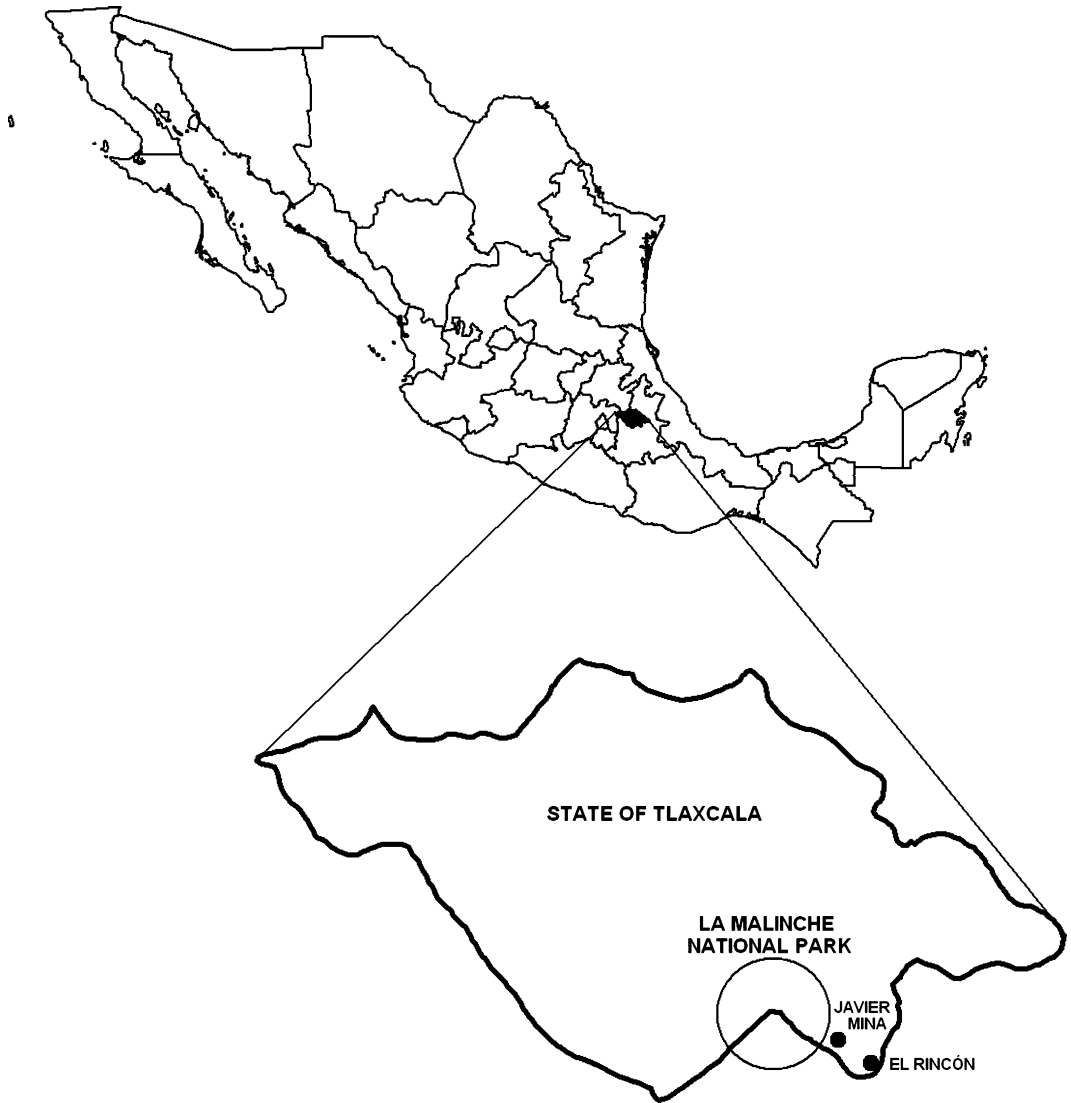


Fig. 1. Map of the study area, showing Javier Mina and the Malinche Volcano area where the people interviewed in this study collect mushrooms. Tlaxcala is located in the central part of Mexico.

store, amount of each species bought in that store per day, the number of people who arrived each day to sell mushrooms, and the criteria the dealer used for choosing the mushrooms bought. In addition, 15 visits were made to El Rincón, a community 5 km south of Javier Mina, where data were recorded on the amounts of different species sold and their prices. The resale price of each species was documented through visits to the markets where the local dealer resold the mushrooms. These markets included la Central

de Abastos de Puebla (a wholesale/retail market on the northern fringes of the city of Puebla), and the markets of La Merced and San Juan Deletrán in Mexico City. Price data were first obtained in 1995; the prices paid to mushroom gatherers in Javier Mina were updated in 2001. In that year, five visits were made in June and July to the same dealer as was visited in 1995, and two visits were made to El Rincón and to the resale markets of Central de Abastos (Puebla) and La Merced (Mexico City). The prices of

mushrooms on sale were updated on these occasions and again in 2006.

Results

MUSHROOM COLLECTING

We recorded 30 species in Javier Mina of commercially valuable wild mushrooms along with their local names, prices, and the different locations where they were resold (Table 1). It was determined that, of the 102 families in Javier Mina, 75 households (74%) gathered and sold mushrooms to the town's dealers during the 1995 rainy season (from May to November) and that 55 of those 75 families (73%) sold their mushrooms only to Doña Elena García (Fig. 2), who owns the store where this study was conducted. In 59 (79%) of the 75 families that collected mushrooms, the person in charge of collecting the mushrooms was a woman; in 16 instances, it was a man. The percentage of mushrooms collected for household use (as opposed to those for sale) could not be determined. Generally, however, it was noted that the older mushrooms, or those not in good shape, were eaten as they would not fetch a good price from the dealer. Occasionally, the collectors also would keep very large mushrooms as objects of pride, or species of which they gathered unusually large quantities.

Mushroom gathering is a social activity among women and children, while men generally like to pick alone. The amount of time collectors dedicate to gathering, the preference of going alone or in groups, as well as the distances traveled per day, all were determined to some degree by competitive pressures among the mushroom collectors. During the months in which the more valuable species (e.g., *Boletus* cf. *pinophilus* and the *Amanita caesarea* complex) appear in large quantities, men prefer to start collecting very early in the morning, without the company of women, since they think women walk too slowly. Women say they walk more slowly because they carry heavy baskets laden with meals and the collected mushrooms. Men tend to search for mushrooms in far-away or difficult-to-access areas such as steep ravines where, according to their experience, valued species *might* grow; in other words, they appear to take more risks. Women seemed more averse to risk, preferring to harvest in closer areas with more reliable (if modest) yields.

Collectors walked at least 8 km and up to 20 km roundtrip per day (the forested area begins 4 km from town at an altitude of 2,800 m). Collectors tended to go further and further afield as the season progressed and various mushrooms appeared. At the beginning, their search was limited to the plains and the *Pinus* and *Pinus–Abnus* forests; later, they extended their search to the *Abies* forests located at higher altitudes (3,600 m). This pattern was due in part to the tendency of the closer mushrooms to be picked first, but also because the higher-elevation species tend to fruit later in the season. Collectors always walked to the collecting grounds except on those few occasions when mushroom dealers transported people to areas further away, such as La Cañada Grande and Albergue IMSS (a forest resort) on La Malinche Volcano. In these more distant areas the competitive pressures were less and the pickers could presumably find more mushrooms, though they would only stay for a few hours and return to their homes the same day. In such cases, the mushroom harvesters did not pay for their transportation but were obligated to sell their mushrooms to the dealer that provided the transport. The forest reserves in which they collect are subject to federal regulations that restrict mushroom gathering (NOM-059-ECOL-2001), but the gatherers and dealers are apparently unaware of the restrictions and the authorities do not enforce them.

All collectors said that they have patches or their "own places" (*lugares propios*), referring to areas that historically produce a great number of mushrooms. As anyone can pick in these places, access is on a first-come, first-serve basis. Therefore, collectors try to conceal their patches from competitors by covering up all signs of collecting such as holes left after removing the mushrooms.

MUSHROOM COMMERCE

Of the 55 families interviewed, none of them sold mushrooms during all 16 of our visits to the dealer. Of those 55 families, 11 collected and sold frequently (between 6 and 12 times during our visits) while 44 families collected and sold occasionally or opportunistically (between one and five times during our visits).

The collectors normally received payment in cash from the mushroom dealer; sometimes they also received gifts of fruit, flowers, or sweets as a

Table 1. MUSHROOM SPECIES OF COMMERCIAL IMPORTANCE IN JAVIER MINA, AND THEIR PRICES IN FOUR DIFFERENT MARKETS.

Scientific name	Traditional name (English translation)	Price by kg in Javier Mina 1995	Price by kg in Javier Mina 2001	Price by kg in El Rincón 1995/2001	Price by kg in Puebla 2001	Price by kg in México D.F. 1995/2001
<i>Amanita caesarea</i> (Scop.) Pers. complex (young) (see <i>A. basii</i> , <i>A. yema</i> , etc. in Guzmán & Ramirez-Guillen 2001)	<i>botón</i> (button)	1.8–2.5	3.2	1.0/3.3	5.4	4.1/7.6
<i>Amanita caesarea</i> complex (mature) (see <i>A. basii</i> , <i>A. yema</i> , etc. in Guzmán & Ramirez-Guillen 2001)	<i>floreado</i> (flowery)	0.7–1.6	2.2–2.8	0.8/2.1	2.7–3.3	1.6–4.0/2.7–3.3
<i>Amanita aff. franchetii</i> (Boud.) Fayod.	<i>yemita</i> (little yolk)	0.2–1.0	-	0.2 (1995)	-	0.3 mixed/not sold
<i>Amanita rubescens</i> sensu auct. mex. non Pers.	<i>mantequillo</i> (butter)	0.2–0.7 some times mixed	0.9	0.2/0.9	1.6	0.7–1.5/1.6
<i>Boletus cf. atkinsonii</i> Peck	<i>pante</i> (N); <i>cimarrón</i> (<i>pante</i> =?); (<i>cimarrón</i> = wild)	0.7	0.5	0.7/0.5	1.3	1.6
<i>Boletus cf. pinophilus</i> Pilát & Dermek (mature)	<i>pante viejo</i> (old <i>pante</i>)	0.3–0.5	0.5–1.1	0.3–0.5 /0.5–1.1	1.1	0.8–1.3 /1.1–1.2
<i>Boletus cf. pinophilus</i> Pilát & Dermek (immature)	<i>pante nuevo</i> (new <i>pante</i>)	0.8–2.2	2.2–2.7	0.8–1.0/2.2	-	1.6/3.3–4.4 and 21.8 dry
<i>Cantharellus cf. cibarius</i> Fr.	<i>tecosita</i> (N); <i>duraznillo</i> (yellow; little peach)	1.0–2.0	2.7	0.3/2.7	-	0.8–2.0/4.4
<i>Clitocybe gibba</i> (Pers.) P. Kumm.	<i>tejamanilero</i> (N) (?)	0.2–0.7	0.5	0.2/0.5	1.1	0.7/1.1
<i>Chroogomphus jamatensis</i> (Murr.) O.K. Mill.	<i>tlapalcocosa</i> (N); <i>palcocosa</i> (N); <i>tecosa morada</i> (<i>tecosa</i> =?; purple <i>tecosa</i>)	0.2–0.3	0.5	0.5	-	1.1–2.0 (1995)
<i>Entoloma cf. clypeatum</i> (L.) P. Kumm.	<i>rosita</i> (little pink)	0.3–1.0	0.5–1.6	0.5–0.8 /0.5–1.6	1.3–2.7	1.5–1.6/1.6–2.2
<i>Gomphus floccosus</i> (Schwein.) Singer	<i>corneta de oyaml</i> (fir trumpet)	0.3	0.9	0.2–0.3 /0.9	1.3–1.63	0.8–1.0/n t sold
<i>Gymnopilus dryophilus</i> (Bull.) Murrill	<i>señorita</i> (young lady)	0.2–0.3	-	0.2/0.5	-	1.1/ not sold
<i>Hebeloma aff. mesophaeum</i> (Pers.) Quél.	<i>xolote</i> (N) (delicate, easily damaged)	0.2–0.3 some times mixed	0.9/1.1	0.2–0.5 /0.9–1.1	1.6	0.3 sometimes mixed /not sold
<i>Helvella crispa</i> (Scop.) Fr.	<i>oreja de ratón</i> (mouse ears)	0.2–1.3	-	0.2 (1995)	-	0.3–0.5 some times mixed

Table 1. (continued).

Scientific name	Traditional name (English translation)	Price by kg in Javier Mina 1995	Price by kg in El Rincón 1995/2001	Price by kg in Puebla 2001	Price by kg in México D.F. 1995/2001
<i>Hebella lacunosa</i> Afzel.	<i>gachupín negro</i> (<i>gachupín</i> = colloquial name for Spaniards; <i>negro</i> =black)	0.2-1.3	0.2 (1995)	0.5	0.5/0.5 sometimes mixed
<i>Hygrophorus chrysodon</i> (Batsch.) Fr.	<i>hucvitos</i> ; <i>palomita</i> (little eggs; little dove)	0.2-0.5	0.3 mixed (1995)	-	0.3/sometimes mixed
<i>Hygrophorus purpurascens</i> Gonn. & Rabenh.	<i>camarón</i> (shrimp)	-	0.3 mixed (1995)	-	0.5/0.5-0.8
<i>Hypomyces lactifluorum</i> (Schwein.) Tul. & C. Tul.	<i>trompa de cochino</i> (pig snout)	-	0.2-0.5 /1.6-2.2	-	0.3-0.8 /3.3
<i>Laccaria trichodermophora</i> G.M. Muell.	<i>xocoyulado</i> (N) (<i>xocoyulli</i> = last child in the family, i.e., it is one of the smallest edible mushrooms)	0.12-0.7 sometimes mixed	0.2-0.3 /0.5	0.9	0.6-0.8 /1.1 sometimes mixed
<i>Lactarius indigo</i> (Schwein.) Fr.	<i>corneta azul</i> (blue trumpet)	0.5-0.8	0.7-0.3 /1.6	2.8-3.1	-
<i>Lactarius</i> cf. <i>sabniconicolor</i> R. Heim & Leclair	<i>enchilado</i> ; <i>corneta roja</i> (red trumpet)	0.2-0.8	0.2-0.5 /0.5	1.1	1.0/1.2
<i>Lyophyllum</i> cf. <i>decastes</i> (Fr.) Singer	<i>blanco</i> ; <i>blanquito</i> (white one; little white one)	0.8-1.3	1.0-1.3 /1.6	2.7	2.3-2.5/3.3
<i>Lyophyllum</i> sp. 1	<i>blanco de mata</i> ; <i>mata</i> (white tuft)	1.0-1.2	1.0-1.3 /1.6	2.7	1.1/3.3
<i>Morchella esculenta</i> sensu auct. mex. non (L.) Pers.	<i>chipotle</i> ; <i>morilla</i> (i.e., it looks like a Mexican chili)	0.2-1.3	-	-	8.7-13.1-17.4
<i>Morchella elata</i> sensu auct. mex. non. Fr.	<i>chipotle</i> ; <i>morilla</i> (i.e., it looks like a Mexican chili)	0.3-1.3	-	-	8.7-13.1-17.4
<i>Ramaria flavobrunnescens</i> (G.F. Atk.) Corner	<i>escobeta amarilla</i> (yellow broom)	0.2-0.5	0.2-0.3 /0.9	1.6	0.3-1.0 /1.1 sometimes mixed
<i>Ramaria rubripermanens</i> Marr & D.E. Stunz	<i>escobeta</i> (broom)	0.2-1.3	0.2-0.3 /0.9	1.1	0.3-1.0 /1.1 sometimes mixed

<i>Russula</i> cf. <i>delica</i> Fr.	<i>corneta</i> ; <i>corneta blanca</i> (trumpet; white trumpet)	0.2–0.3 sometimes mixed	0.5	0.2–0.5 / 0.5	0.9–1.1	0.3–0.8/3.3 sometimes mixed
<i>Suillus granulatus</i> (L.) Roussel	<i>panza</i> ; <i>pancita</i> (little belly)	0.2–0.5	0.5	0.5 (2001)	-	not sold/1.1
<i>Suillus pseudobrevipes</i> A. H. Sm. & Thiers	<i>panza</i> ; <i>pancita</i> (little belly)	0.2–0.5	0.5	0.5 (2001)	-	not sold/1.1
<i>Tricholoma</i> cf. <i>equestre</i> (L.) P. Kumm.	<i>cailita</i> (N) (?)	0.2–0.3	0.5	-	1.1	0.4/1.1

All vouchers deposited by A. Montoya in TLXM. Prices are given in U.S. dollars (USD 1 = 6.08 Mexican pesos in 1995 and 9.19 Mexican pesos in 2001). The short dash indicates that data was unavailable; an (N) indicates a Nahua name.

reward for selling their mushrooms to the dealer and as an incentive for continuing to do so. It was noted that prices were higher at the beginning and end of the mushroom season when the mushrooms were less plentiful. However, the price per kilo for each mushroom species varied according to what the dealer could get in Mexico City; therefore, the national (not just the local) supply affected the price. Most of the mushrooms were sold fresh. Some *Boletus*, however, were sliced and dried for later sale in Mexico City, and some *Morchella* were dried or frozen by the dealer. With valuable, highly perishable species such as the *Amanita caesarea* complex and *Boletus* cf. *pinophilus*, a higher price was paid for immature (versus mature) mushrooms (Table 1). Mushrooms that were in low demand or were scarce were not worth separating; instead, they were mixed together and sold in markets at bargain prices as *revoltijo* or *hongos revueltos* (“fungal jumble”). Mushrooms commonly found in such mixtures included *Amanita* aff. *franchetii*, *Clitocybe gibba*, *Gomphus floccosus*, *Gymnopus dryophilus*, *Hebeloma* aff. *mesophaeum*, *Helvella* spp., *Hygrophorus chrysodon*, *Hygrophorus purpurascens*, *Laccaria trichodermophora*, *Lactarius* cf. *salmonicolor*, *Ramaria* spp. *Russula* cf. *delica*, *Suillus* spp. and *Tricholoma* cf. *equestre*.

During the 16 weekly surveys, it was observed that the amount of time invested in mushroom collection ranged from 8 to 11 hours per day ($\bar{x}_{(n=55)} = 8.87$ hours). In this amount of time, a family could gather at least 600 grams (g) and at most 20.15 kilograms (kg) ($\bar{x}_{(n=55)} = 6.7$ kg) of mushrooms. In 1995, these collection efforts generated, on average, an income per family per day of 62.5 Mexican pesos (USD 10.27).

The dealer bought a total of 1,323 kg of mushrooms during our visits, paying 6,006 Mexican pesos (USD 986), for an average of 83 kg per survey day and 375 Mexican pesos (USD 62). Although an average of 12 households sold mushrooms to the dealer each day, this number varied throughout the mushroom season, from a maximum of 28 people on one day in June to only 2 or 3 people per day in September and October.

The greatest payment was 999 Mexican pesos (USD 164) on July 6; the lowest was 35 Mexican pesos (USD 6) on September 14. The greatest amount of mushrooms sold by a single family was 127 kg. That family came in to sell on 12 of the



Fig. 2. María Elena García Montes, a mushroom buyer of Javier Mina, showing off a mushroom of the genus *Boletus* to be sold in Mexico City. (Adriana Montoya, all rights reserved).

16 survey visits during 1995, earning 550 Mexican pesos (USD 90).

As a follow-up to this study, we asked the same Javier Mina mushroom dealer to tell us the prices of selected mushroom species in 2006 (Table 2). The prices were lower than in 2001, at least for the *A. caesarea* complex and *Boletus* cf. *pinophilus*. The dealer attributed the lower prices to stiff competition from the neighboring states of Mexico and Hidalgo.

During this study, we also noted that a few mushroom species were collected mostly for home consumption, as apparently there was little or no market for them. These species included *Agaricus campestris* L., *Pleurotus opuntiae* (Durieu & Lév.) Sacc., *Suillus granulatus* (L.) Roussel, *S. pseudobrevipes* A.H. Smith & Thiers, and *Ustilago maydis* (DC.) Corda.

THE PURCHASE OF MUSHROOMS IN NEIGHBORING COMMUNITIES

The Javier Mina dealers bought mushrooms in Javier Mina as well as in the two neighboring communities of El Rincón and San Pablo Zitlaltépetl, dedicating approximately six hours per day to this activity. The mushrooms bought in the latter two communities were mixed with those from Javier Mina except for *Hypomyces lactifluorum* and *Hygrophorus purpurascens*, which were bought in El Rincón but do not seem to occur in the forest near Javier Mina.

During our 15 visits to El Rincón in 1995, one dealer (Sra. Elena García) purchased 1,200 kg of wild mushrooms at a cost of 4,073 Mexican pesos (USD 669). The dealer bought an average of 80 kg per day (272 Mexican pesos or USD 45) during our visits in

1995, but in 2001 the daily average was only 49 kg at a cost of 612 Mexican pesos (or USD 67). (The dealer said that 1995 was a good year for wild mushrooms.) Our data also show that families in El Rincón averaged 6.5 kg of mushrooms per survey day in 2001, for an income of around 80 Mexican pesos (or USD 13).

During our visits in 1995, the Javier Mina dealer bought a combined total of 2,522 kg of mushrooms from Javier Mina and El Rincón, for which she paid 10,078 Mexican pesos (or at that time, USD 1,655). Mushrooms purchased in these communities were transported every day during the mushroom season to the Central de Abastos in the State of Puebla (in 2001 only), where they were sold retail, and to La Merced and San Juan Deletrán markets in Mexico City (a drive of three and one-half hours), where they were sold wholesale.

Discussion

ECONOMIC BENEFITS OF MUSHROOM HARVEST

It is difficult to know how long inhabitants of Javier Mina have been collecting mushrooms. People nearly 80 years old said that their parents and grandparents picked mushrooms, which indicates that members of this community have collected at least since the founding of the town and probably before. Currently, about three-quarters (73.5%) of Javier Mina's inhabitants collect, consume, and sell mushrooms each rainy season.

The wild mushroom harvest is clearly lucrative. While the minimum wage in the State of Tlaxcala was 15.44 Mexican pesos (USD 2.54) per day in 1995, the average mushroom earnings per family (the average family size is five) in Javier Mina ranged from 62 to 82 Mexican pesos (USD 10.27–13.47) for each day for collecting. Since it requires little or no capital investment, mushroom gathering clearly supplements the local family economy and, for some families, represents the most important source of income during the summer months along with the harvest of corn, fava beans, and capulin seeds (*Prunus capuli* Cav. ex Spreng.). The resale of the mushrooms in the markets of Puebla and Mexico City is also a lucrative activity though it requires some capital. The dealer we studied generally realized a gross profit of 100% for fresh mushrooms and up to 10 times as much for those that were dried or frozen.

Our study indicates that the most valuable species in the Javier Mina area are *Boletus* cf. *pinophilus*, *Morchella* spp., the *Amanita caesarea* complex, *Cantharellus* cf. *cibarius*, and *Lyophyllum*

Table 2. SELECTED MUSHROOM SPECIES OF COMMERCIAL IMPORTANCE IN JAVIER MINA AND THEIR PRICES IN 2006.

Scientific name	Price by kg in Javier Mina/La Merced, Mexico City (2006)
<i>Amanita caesarea</i> complex, buttons (see <i>A. basii</i> , <i>A. yema</i> , etc. in Guzmán & Ramírez-Guillen 2001)	3.18/4.5
<i>Amanita caesarea</i> complex, mature (see <i>A. basii</i> , <i>A. yema</i> , etc. in Guzmán & Ramírez-Guillen 2001)	2.7/3.6
<i>Boletus</i> cf. <i>pinophilus</i>	1.0
<i>Boletus</i> cf. <i>pinophilus</i>	1.0
<i>Boletus</i> cf. <i>pinophilus</i>	2.7/3.6
<i>Entoloma</i> cf. <i>clypeatum</i>	1.36
<i>Gomphus floccosus</i>	0.9/1.36
<i>Lactarius</i> cf. <i>salmonicolor</i>	
<i>Lyophyllum</i> cf. <i>decastes</i>	0.9/1.63
<i>Lyophyllum</i> sp. 1	1.36–3.18/4.5
<i>Ramaria</i> spp.	0.9/1.4

Prices are given in U.S. dollars (USD 1=11.0 Mexican pesos).

cf. *decastes*, and that the most abundant species (at least in terms of amounts sold) are *Boletus* cf. *pinophilus*, the *Amanita caesarea* complex, *Lyophyllum* cf. *decastes*, and *Amanita rubescens* (Table 3). It is also interesting to note that some mushrooms are favored by the people of Tlaxcala (and Javier Mina) more than elsewhere. For instance, some collectors attribute high value to *Gomphus floccosus* because of its good taste, yet that species isn't widely eaten in the United States. Others, such as *Amanita* aff. *franchetii* and *Rhizopogon michoacanicus* Trappe & Guzmán, do not appear to be consumed locally but are sold only in the markets of Mexico City.

The second price survey, conducted in 2001, showed that prices paid to collectors had doubled or nearly doubled for most species, though the change was about the same as the inflation rate over that period. However, the prices for *Lactarius indigo* and *L.* cf. *salmonicolor* remained about the same, probably reflecting low demand. In 2001, the dealer was still making a gross profit of about 100% by reselling the mushrooms in Puebla and Mexico City.

In 2006, the prices were lower than in 2001, at least for the *A. caesarea* complex and *Boletus* cf. *pinophilus* (Table 2). According to the dealer, 2006 was a poor year for mushrooms in Tlaxcala

but competition from mushroom sellers in other parts of Mexico (e.g., the states of Mexico and Hidalgo) kept the prices low.

OTHER BENEFITS OF MUSHROOM HARVEST

Although our research shows that most of the mushrooms gathered in Javier Mina are sold, those mushrooms gathered for personal consumption also play an important function: they help diversify an otherwise monotonous diet during the rainy season when many food resources are scarce.

Mushroom gathering also has social benefits and cultural significance (Mariaca Méndez et al. 2001; Montoya et al. 2002). It reinforces kinship and friendship within the community and the marketplace, and it unites families (especially women and children) in their work. Mushroom gathering also involves the exchange of information and stories about mushrooms during the trips to the forest and at the point of sale in the community. Of course, there is a good deal of competition for good mushroom sites, as evidenced by the early hours at which people leave their homes during the height of the mushroom season and by the distances they travel. There is also competition between local dealers, who each wish to obtain the greatest amount of mushrooms possible.

MUSHROOM KNOWLEDGE

The people of Javier Mina have categorized the surrounding forest areas in terms of the mushrooms they produce, naming them based on physical characteristics or other outstanding geographical features, and knowing in detail which mushrooms grow in each area. For example, *la monera mocha* ("the broken stone") is a place with pine trees surrounding a big stone that looks like a broken column; this is where gatherers look for *Boletus* cf. *pinophilus*. Another is *el lindero* ("the borderline"), a place along the road forming part of the border of the state of Tlaxcala, where gatherers look for the *Amanita caesarea* complex. Of course, mushroom knowledge is not evenly distributed. In Javier Mina, as elsewhere, there are certain people renowned for their identification skills and knowledge about mushrooms. They are usually the ones who collect the greatest amount of mushrooms and/or those of the best quality.

Specific biological and geographical knowledge about mushrooms, from their identifying charac-

Table 3. NUMBER OF FAMILIES COLLECTING EACH MUSHROOM SPECIES AND THE TOTAL AMOUNT THEY SOLD IN ONE JAVIER MINA STORE IN 1995.

Species	Kg collected by all families registered	Number of families which collect each species
<i>Amanita caesarea</i> complex (immature)	125.8	48
<i>Amanita caesarea</i> complex (mature)	93.8	37
<i>Amanita</i> aff. <i>franchetii</i>	2.6	3
<i>Amanita rubescens</i> sensu auct. mex.	65.3	31
<i>Boletus</i> cf. <i>atkinsonii</i>	2.0	1
<i>Boletus</i> cf. <i>pinophilus</i> (immature)	212.5	51
<i>Boletus</i> cf. <i>pinophilus</i> (mature)	176.6	49
<i>Entoloma</i> cf. <i>clypeatum</i>	32.9	26
<i>Gomphus floccosus</i>	5.1	3
<i>Gymnopus dryophilus</i>	0.3	1
<i>Hebeloma</i> aff. <i>mesophaeum</i>	162.1	21
<i>Helvella crispa</i>	2.8	3
<i>Helvella lacunosa</i>	0.2	1
<i>Hygrophorus chrysodon</i>	0.8	1
<i>Laccaria trichodermophora</i>	8.6	8
<i>Lactarius salmonicolor</i>	0.6	1
<i>Lyophyllum</i> cf. <i>decastes</i>	206.9	42
<i>Lyophyllum</i> sp.1	50.6	9
<i>Morchella esculenta</i> sensu auct. mex.	0.3	3
<i>Ramaria</i> spp.	70.7	26
<i>Russula</i> cf. <i>delica</i>	21.4	14
Mixture of species (<i>Clitocybe gibba</i> , <i>Chroogomphus jamaicensis</i> , <i>Hygrophorus</i> <i>crisodon</i> , <i>Hygrophorus purpurascens</i> , <i>Tricholoma</i> cf. <i>equestre</i> , <i>Suillus granulatus</i> , <i>S. pseudobrevipes</i>)	94.6	28

teristics and culinary qualities to the particular conditions, habitats, and places they favor, is handed down from one generation to the next, thereby constituting an important part of local culture that is actively evolving. Some species that were not collected in the past, such as *Amanita* aff. *franchetii*, are now being picked for sale in Mexico City, while others whose value has increased (the *Amanita caesarea* complex, *Hebeloma* aff. *mesophaeum*, *Boletus* cf. *pinophilus*) are subjected to various practices aimed at increasing their production (Montoya et al. 2002).

The people of Javier Mina (especially the elders) repeatedly point out that they find far fewer mushrooms nowadays than in the past. They attribute this to the fact that more people now search for mushrooms because of their commercial value, whereas in the past mushrooms were used only for home consumption. Also, some people from nearby communities cut living trees so that they can sell the wood and burn the forest floor as a way of managing the

forest. Unfortunately, they have no way of controlling these fires and many acres of prime mushroom habitat are burned each year (a few mushroom species fruit abundantly after fires, but most species die along with the trees).

Forest reserves like La Malinche National Park are crucial to the wild edible mushroom trade. Therefore, it is important to understand the costs and benefits of this activity and to learn more about traditional harvest practices and their relationship to the conservation and sustainable use of forest resources.

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