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COMMERCIALIZATION OF WILD MUSHROOMS DURING MARKET DAYS OF TLAXCALA, MEXICO

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ABSTRACT

Three “tianguis” (popular market days) in the State of Tlaxcala were visited in order to monitor wild edible fungi being sold, their prices and seasonal availability, as well as to interview mushroom sellers. Most species reported were found in the market of Tlaxcala city, and their prices varied seasonally. Although this is a common traditional practice in central Mexico, it is interesting that no commercial or official regulations for selling wild mushrooms have been implemented.

Key words: Wild edible mushrooms, ethnomycology, commercialization, Tlaxcala, Mexico.

INTRODUCTION

Ethnomycological studies involving Mexican indigenous communities have been carried out in different regions, dealing with magic mushrooms, traditional knowledge and classification, as well as selling practices^{5, 6, 7, 12, 17, 20}. There is a wide variety of popular markets in Mexico. In the State of Tlaxcala, there are two main types of markets: 1) Established markets, and 2)

The “tianguis”. Diverse local and regional products are available in established markets, whereas in the “tianguis” or market days varied products available locally and seasonally are sold at lower prices. Several forest products can be found, such as wild edible fungi, the “ocote” (pine timber chips), wood, charcoal, medicinal plants, and ornamental flowers.

Taking into consideration a high diversity of wild mushrooms offered in the markets

from the State of Tlaxcala, their importance to the rural household economy, and the lack of studies in which a record of the commercialized mushrooms is made, we carried out a long-term research on the traditional ethnomycological knowledge in three popular “tianguis”. We present here research data for the period 1989-1991.

MATERIALS AND METHODS

“Tianguis” or market days in the State of Tlaxcala are carried out in specific days of the week. In Tlaxcala city, the “tianguis” occurs on Saturdays; in Huamantla city on Wednesdays; and in Apizaco city on Sundays. Three markets were visited every eight days during rainy seasons (July-September) from 1989-1991, considering the high number of fungal species being sold. Mushroom sellers were interviewed, and personal observations were taken at the markets for obtaining direct information. Interviews (*ca.* 80) involved conversations about rural communities of origin, places for gathering wild mushrooms and other fungi, popular names of mushrooms, cooking, and seasonal information on mushrooms. Mushroom prices throughout the rainy season are presented at the time of this publication (USD \$ 1.00 = \$ 9.60 Mexican pesos). Popular names, either Spanish or Nahuatl, were spelled according to their pronunciation, and for this reason they were not translated to English. Fungal specimens were identified following conventional procedures, such as microscopic observations (cap, gills, stipe) and the use of different reagents [alcohol, KOH (5-15%), Melzer’s reagent, cotton blue, Congo red] ^{4,7}. Identification of fungal species was carried out according to available literature ^{1, 2, 3, 9, 10, 11, 13, 14, 15, 16, 18, 19}.

Dry specimens were deposited at the TLXM herbarium ⁸.

RESULTS AND DISCUSSION

Fifty two fungal species with their popular names (Spanish, Nahuatl-Spanish, Nahuatl) were recorded (**Table 1**). Popular names referred to particular places or substrates where fungal species grow (“ocoxale”), to their colour (“amarillo”, “hongo azul”), or to their similarity with common objects (“sombbrero”, “campanita”, “tecajete”). The number of species appears to be higher, as several specimens of the genera *Ramaria* (A. Montoya, no. 969, 993, 994), *Amanita* (A. Montoya, no. 970a), *Armillaria* (A. Montoya, no. 853), *Psathyrella* (A. Montoya, no. 855), and *Agaricus* (A. Montoya, no. 851, 965) were not identified to species due to the lack of several fruit-body structures or mature fruit bodies. A total of 91 popular names (33, Nahuatl origin) were recorded.

The highest number of species (40) and common names (55) were recorded in the market of Tlaxcala city (**Table 2**; **Fig. 1**). Many fungal species and their popular names found in Tlaxcala city differed from those recorded in Apizaco and Huamantla (**Fig. 2**), as they were collected in different forest regions. This was, for example, the case of *Amanita vaginata*, *A. tuza*, and *Sarcodon imbricatus*, as well as several species of *Russulaceae* (10 species). There were also several mushrooms well known by consumers, such as *A. caesarea*, *Boletus pinophilus*, *Laccaria bicolor*, *Hebeloma mesophaeum*, *Ramaria flavobrunnescens* and *Ustilago maydis*, which had the same popular name in the three markets. In other cases, the same popular name applied to different fungal species, *e.g.* “hongo de ocote” used to name either *Pholiota lenta*

Table 1. Fungal species recorded in the markets of Tlaxcala State, Mexico, and their popular names.

Scientific name	Popular name	M
<i>Agaricus campestris</i> L.: Fr.	hongo de agua (S)	A
	hongo de llano (S)	A, H
	san juanero (S)	A
	hongo de pasto (S)	T
<i>Agaricus</i> sp.	paloma (S)	H
	soles (S)	H
<i>Amanita caesarea</i> (Scop.: Fr.) Pers.	amarillo (S)	A, H, T
	ayoxochitl (N)	T
	huevo (S)	T
	iztacnanacatl (N)	T
	tejocote (S)	A
	tolte (N)	A
<i>Amanita tuza</i> Guzmán	hongo blanco (S)	T
<i>Amanita vaginata</i> (Bull.: Fr.) Vitt.	hongo blanco (S)	T
	ilia negrito (N/S)	T
	ojitos de venado (S)	T
<i>Armillaria</i> sp.	yemita (S)	H
<i>Boletus pinophilus</i> Pilát & Dermek	pante (S)	A, H, T
<i>Calvatia cyathiformis</i> (Bosc.) Morgan	bolas, bolitas (S)	A, T
	burrita (S)	A
	cabeza (S)	A
	cabezona (S)	T
	cefamil (N)	A, H
	pedo de coyote (S)	H
<i>Cantharellus cibarius</i> L.: Fr.	tecosa, tecosita (N)	H, T
<i>Clavariadelphus truncatus</i> (Qué.) Donk	chichis de vaca (S)	*
	mamilas (S)	T
<i>Clitocybe gibba</i> (Pers.) Kumm.	campanitas (S)	T
	sombrerito (S)	H
	tecajete (N)	T
	tejamanilero (N)	H
<i>Cortinarius glaucopus</i> (Schaeff.: Fr.) Fr.	moradito (S)	H
	xeloshinanacatl (N)	T
<i>Chroogomphus jamaicensis</i> (Murr.) Miller	borrachito (S)	A, H
	tecajete (N)	T
	xolete (N)	H, T
<i>Entoloma clypeatum</i> L.: Fr.	rosita (S)	H
	xolete rosita (N/S)	A, T
<i>Gomphus floccosus</i>	corneta (S)	A, H

Table 1 continued

(Schw.) Sing.	corneta de oyamel (S)	A, H
	trompeta (S)	T
<i>Gymnopus dryophilus</i> (Bull.: Fr.) Murr.	paragüitas (S)	T
	popotitos (S)	T
<i>Hebeloma mesophaeum</i> (Pers.: Fr.) Qué.	hongo de ocote (S)	A, H, T
	ocoxalero (N)	T
	ocoxale (N)	T
	xolete (N)	T
<i>Helvella acetabula</i> (L.: Fr.) Qué.	oreja de ratón (S)	T
<i>Helvella infula</i> Schaeff.	menudo (S)	H
	oreja de padre roja (S)	H
<i>Helvella lacunosa</i> Fr.	oreja de padre negra (S)	H
	soldaditos (S)	H
<i>Hygrophorus chrysodon</i> (Batsch.: Fr.) Fr.	niños (S)	H
<i>Hypomyces lactifluorum</i> (Schw.) Tul.	hongo colorado (S)	T
	hongo corneta (S)	T
	hongo de encino (S)	A, H
	enchilado (S)	T
	tenaxnaca (N)	T
<i>Laccaria bicolor</i> (Mre.) Pat.	xocoyule (N)	A, H, T
<i>Lactarius indigo</i> (Schw.) Fr.	añil (N)	A
	ateconza, aticonzol (N)	A, T
	hongo azul (S)	A, T
	tecax azul (N/S)	A, T
	tecosán morado (N/S)	T
	tlapaltécax (N)	T
<i>Lactarius salmonicolor</i> Heim & Leclair	antitecax (N)	T
	enchilado (S)	H, T
<i>Lactarius yazoensis</i> Hesl. & A.H. Sm.	enchilado (S)	T
<i>Lepista nuda</i> (Bull.: Fr.) Cke.	arrieros (S)	T
	matlalitos (N)	T
<i>Lycoperdon perlatum</i> Pers.	bola, bolita (S)	A, T
	huevoito (S)	H
	pedo de coyote (S)	H
	popotitos (S)	T
<i>Lyophyllum decastes</i> (Fr.) Sing.	clavito (S)	A, T
	tlalixta (N)	A
	xolete (N)	A, T
	tzenzo (N)	T
<i>Lyophyllum ovisporum</i> Reid	hongo blanco (S)	T
	cuaresmeño (S)	H
	matas o macetas (S)	H

Table 1 continued

<i>Marasmius oreades</i> (Bolt.: Fr.) Fr.	xolete de llano (N/S)	A, T
<i>Morchella esculenta</i> L.: Fr.	chipotle (N)	H
<i>Pholiota lenta</i> (Fr.) Sing.	hongo de ocote (S)	A, T
	cuapes (N)	T
	cuatetes (N)	T
<i>Pleurotus opuntiae</i> (Durieu & Lévellé) Sacc.	hongo de maguey (S)	H, T
<i>Pluteus cervinus</i> (Schaeff.: Fr.) Kumm.	hongo de ailite (S)	H
<i>Psathyrella</i> sp.	?	H
<i>Ramaria flavobrunnescens</i> (Atk.) Corner	escobeta amarilla (S)	A, H, T
<i>Ramaria rubripermanens</i> Marr. & Stuntz	escobeta morada (S)	H
<i>Ramaria</i> sp.	cuecuetlax (N)	T
<i>Russula alutacea</i> (Pers.: Fr.) Fr.	pastelito (S)	T
<i>Russula cyanoxantha</i> (Schaeff.) Fr.	pastelito (S)	T
<i>Russula delica</i> Fr.	nacascuetlax (N)	T
	orejitas (S)	H
	pata de cabra (S)	A, H
	tecax (N)	A, H, T
	tecax blanco (N/S)	A, T
	tecajete (N)	T
	toropos (N)	H
<i>Russula mariae</i> Pk.	hongo colorado (S)	T
<i>Russula olivacea</i> (Schaeff.) Pers.	san pablero (S)	*T
<i>Russula romagnesiana</i> Shaffer	palomita (S)	H
<i>Russula xerampelina</i> (Schaeff.) Fr.	san pablero (S)	*T
<i>Sarcodon imbricatus</i> (L.: Fr.) Karst.	chipo de toro (S)	T
<i>Stropharia coronilla</i> (Bull.: Fr.) Quél.	xolete de zacatón (N/S)	H
<i>Suillus pseudobrevipes</i> A.H. Sm. & Thiers	pancita (S)	A, H, T
	tepopoz (N)	T
<i>Tricholoma flavovirens</i> (Pers.: Fr.) Lund.	cailita (S)	A, H
<i>Tylopilus felleus</i> (Bull.: Fr.) P. Karst.	pante (S)	T

Table 1 continued

<i>Ustilago maydis</i> D.C. Corda	cuitlacoche (N)	A, H, T
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M= Market. A= Apizaco. H= Huamantla. T= Tlaxcala. S= Spanish name. N= Nahuatl name. N/S= Nahuatl-Spanish name.

* Species known and consumed as a food by mushroom pickers of the Huamantla market; however, they are not popular, and accordingly not commercialized.

? Popular name unknown, as mushrooms were found mixed in a pile, and lacking fruit-body structures.

or *Hebeloma mesophaeum*; and “hongo blanco” for naming *Lyophyllum ovisporum* (Fig. 3), *Amanita vaginata*, as well as *A. tuza*.

According to the information provided by indigenous peasants, most mushrooms sold at the markets of Apizaco and Huamantla were normally collected in coniferous forests from “La Malinche” Volcano (Fig. 4), while mushrooms sold at the market of Tlaxcala city were usually gathered in *Pinus-Quercus* forests from central and northern parts of the States of Tlaxcala (Fig. 5), Puebla, and occasionally the State of Mexico. Peasant pickers walk through the forest about 4-5 km in a day to collect

Table 2. Fungal species and popular names recorded in markets visited during 1989-1991.

Market	Number of species	Number of popular names
Apizaco	20	26
Huamantla	33	41
Tlaxcala city	40	55

mushrooms. Peasants selling edible fungi at the market of Tlaxcala city came from nearby rural communities, and occasionally from others in the State of Mexico (e.g., “Los Volcanes”, “Río Frío”).

It was interesting to record sporadically *Cortinarius glaucopus* (A. Montoya, no. 1207, 1208), *Tylophilus felleus*, *Psathyrella* sp., and *Stropharia* sp. being sold in popular markets (Huamantla, Tlaxcala city) for the first time in Mexico. However, further field or experimental observations are needed to confirm their edibility and acceptance by consumers.

According to the information from interviews and direct observations, *Boletus pinophilus*, *Amanita caesarea* (Fig. 6), and *Agaricus campestris* showed the highest prices and demand by consumers (Table 3). Mushroom species sold at the lowest price were *Calvatia cyathiformis* and *Russula delica*. The price varied according to the availability of every mushroom species, being more expensive at the beginning and towards the end of the natural fruiting period. There was competition between mushroom sellers, mainly during June and August when a variety of fungal species is available and many mushroom pickers can be found, a situation which may keep prices down. Mushroom prices are normally set by the seller, who may be dedicated exclusively to the commercialization of mushrooms on market days in different localities. Several mushroom species increased their price per kilo significantly within three years. For example, *Boletus pinophilus* cost USD \$ 0.10 in 1988, whereas in 1991 its cost was USD \$ 0.52-0.83.

Mushroom sellers can be peasant men and/or women, and occasionally children, who normally carried a basket containing 4-5 kg of wild fungi to be sold in 5-7 h. The traditional manner of selling mushrooms is

Table 3. Prices for several wild edible mushrooms at popular markets in the State of Tlaxcala, Mexico, during 1989-1991.

Species	Price (USD \$)	M
<i>Agaricus</i>	0.10-0.63 per pile	A
<i>campestris</i>	0.42-0.83 kg	A
	0.10-0.73 per pile	T
<i>Agaricus</i> sp.	0.36-0.42 per pile	H
	0.10-0.73 per pile	T
<i>Amanita</i>	0.10 per pile	A
<i>caesarea</i>	0.52 per pile	H
	0.10-0.73 per pile	T
<i>Amanita</i>	0.16 per pile	T
<i>vaginata</i>		
<i>Boletus</i>	0.10-0.83 per pile	A
<i>pinophilus</i>	0.31-0.83 per pile	H
	0.21-0.52 per pile	T
<i>Calvatia</i>	0.052-0.10 per pile	T
<i>cyathiformis</i>		
<i>Clitocybe</i>	0.21 per pile	H
<i>gibba</i>		
<i>Cortinarius</i>	0.21 per pile	H
<i>glaucopus</i>		
<i>Chroogomphus</i>	0.21 per pile	H
<i>jamaicensis</i>		
<i>Gomphus</i>	0.21 per pile	A
<i>floccosus</i>	0.21 per pile	H
<i>Hebeloma</i>	0.10-0.26 per pile	A
<i>mesophaeum</i>	0.26 per pile	H
<i>Hypomyces</i>	0.52 per pile	T
<i>lactifluorum</i>		
<i>Laccaria</i>	0.42 per pile	A
<i>bicolor</i>	0.21 per pile	H
<i>Lactarius</i>	0.10 per pile	A
<i>salmonicolor</i>	0.42 per pile	H, T
<i>Lycoperdon</i>	0.21 per pile	T
<i>perlatum</i>		
<i>Lyophyllum</i>	0.52 per pile	H
<i>ovisporum</i>		
<i>Pholiota lenta</i>	0.21 per pile	T

Table 3 continued

<i>Pleurotus opuntiae</i>	0.52 per pile	H, T
<i>Psathyrella</i> sp.	0.21 per pile	T
<i>Ramaria</i> spp.	0.21-0.42 per pile	A
	0.21-0.52 per pile	H
	0.10-0.21 per pile	T
<i>Russula delica</i>	0.010 per fruit body	A
<i>Suillus pseudobrevipes</i>	0.10 per pile	A
<i>Ustilago maydis</i>	0.10-0.52 per pile	A
	0.63 per pile	T

M= Market. A= Apizaco. H= Huamantla. T= Tlaxcala.

by small piles of only one species, or different species mixed in the pile (normally those which are cooked in the same way) [Fig. 7]. The average weight of a pile varied from 100-250 g. Mushroom species commonly sold mixed in piles are: *Lactarius yazooensis*, *Russula cyanoxantha*, *R. delica*, *R. mariae*, *Clitocybe gibba*, *Laccaria bicolor*, *Helvella lacunosa*, and *Gymnopus dryophilus* (Fig. 8). Those species normally sold separately are: *Amanita caesarea*, *Boletus pinophilus*, *Lactarius indigo*, *Ramaria rubripermanens*, and *R. flavobrunnescens*, among others. *Cortinarius glaucopus*, *Armillaria* sp., *Pluteus cervinus*, *Amanita vaginata*, *A. tuza*, *Sarcodon imbricatus*, *Helvella infula*, *Tricholoma flavovirens*, and *Helvella acetabula* were sold mixed with each other or with other species, usually in small amounts. In this case, mushroom prices were mainly fixed according to the pile size and the amount of mushrooms, regardless of the species, varying from USD \$ 0.10-0.21. Mushrooms can be transported long distances ranging from 3-55 km (Fig. 9), and are usually shown beside charcoal,

i.e. towards the outer part of the market. Mushroom sellers may also sell other items, such as pieces of “ocote”, glass bottles, or some vegetables (*e.g.*, pumpkin flowers or chilli).

In a traditional form of trading, similar to that carried out in prehispanic times, wild edible mushrooms can also be swapped for vegetables (chillies), fruits (apples), sweet bread, maize products (“tlacoyos”), cheeses, or other items of domestic use (“ocotes”).

Mushroom species found on sale in the markets varied according to the rainy season in the State of Tlaxcala (May-October). The highest number of species were recorded during June, July, and August (Table 4). There were mushroom species having an early and short phenology, being only observed during May and June. Other species, such as *Pholiota lenta* and *Psathyrella* sp., were only found during October. Interesting was the case of *Russula delica*, which was recorded during the entire rainy season.

Further ethnomycological studies, as well as official regulations and supervision by trained personnel, on wild edible fungi being sold at the markets of central Mexico are recommended, because financial difficulties might force peasants not familiar with gathering practices to commercialize edible fungi. This will directly benefit consumers, and the commercialization of wild edible fungi will improve.

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Figs. 1-5. Mushroom commercialization in city markets from the State of Tlaxcala, Mexico. 1-2: Indigenous peasant women selling wild edible mushrooms. 3: “Hongo de mata”, a popular Spanish name for *Lyophyllum ovisporum*. 4-5: *Pinus-Quercus* (4) and coniferous (5) forests where mushrooms are collected.



Figs. 6-8. Mushroom commercialization in markets from the State of Tlaxcala, Mexico. 6: “Ayoxochitl”, a popular Nahuatl name for *Amanita caesarea*. 7: “Pastelitos”, a popular Spanish name for several species of *Russula*. 8: Several mushroom species to be sold per pile.

Table 4. Fungal species and their availability for sale along the year during the rainy season (1989-1991) at the markets of Tlaxcala, Mexico.

Species	Month					
	M	Jn	Jl	A	S	O
<i>Lyophyllum ovisporum</i>	*	*				
<i>Calvatia cyathiformis</i>	*	*	*			
<i>Ramaria</i> sp.	*	*	*	*		
<i>Amanita caesarea</i>	*	*	*	*		
<i>Boletus pinophilus</i>	*	*	*	*	*	
<i>Clitocybe gibba</i>	*	*	*	*	*	
<i>Lyophyllum decastes</i>	*	*	*	*	*	
<i>Tricholoma flavovirens</i>	*	*	*	*	*	
<i>Russula delica</i>	*	*	*	*	*	
<i>Hypomyces lactifluorum</i>		*				
<i>Agaricus campestris</i>		*	*			
<i>Hebeloma mesophaeum</i>		*	*			
<i>Pleurotus opuntiae</i>		*	*			
<i>Russula</i> spp.		*	*			
<i>Lactarius indigo</i>		*	*	*		
<i>Suillus pseudobrevipes</i>		*	*	*		
<i>Agaricus</i> sp.		*	*	*	*	
<i>Lycoperdon perlatum</i>		*	*	*	*	
<i>Ustilago maydis</i>		*	*	*	*	
<i>Gymnopus dryophilus</i>			*			
<i>Chroogomphus jamaicensis</i>				*		
<i>Sarcodon imbricatus</i>			*			
<i>Pluteus cervinus</i>			*			
<i>Ramaria flavobrunnescens</i>				*		
<i>Ramaria rubripermanens</i>			*			
<i>Lactarius salmonicolor</i>			*	*		
<i>Lepista nuda</i>			*	*		
<i>Entoloma clypeatum</i>			*	*	*	
<i>Gomphus floccosus</i>			*	*	*	
<i>Laccaria bicolor</i>			*	*	*	
<i>Stropharia</i> sp.			*	*	*	
<i>Cantharellus cibarius</i>			*	*	*	
<i>Lactarius yazoensis</i>			*	*	*	
<i>Hygrophorus chrysodon</i>				*	*	
<i>Morchella esculenta</i>				*	*	
<i>Cortinarius glaucopus</i>					*	

Table 4 continued

<i>Helvella infula</i>	*
<i>Pholiota lenta</i>	*
<i>Psathyrella</i> sp.	*

* Mushroom species recorded during each month.
M=May. Jn=June. Jl=July. A=August. S=September.
O=October.

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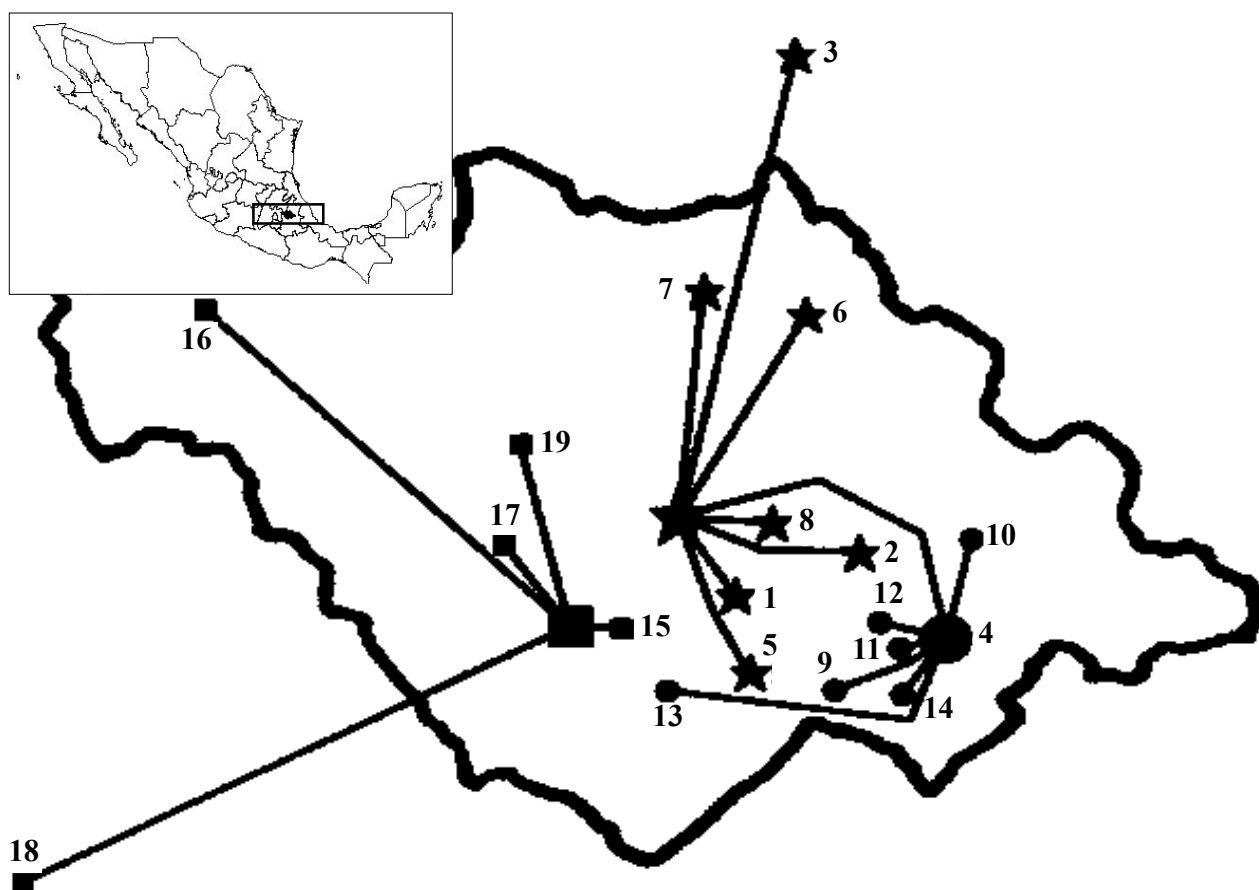


Fig. 9. Rural communities where indigenous peasants move from in order to sell their wild edible mushrooms in the city markets of Apizaco, Huamantla, and Tlaxcala city. * = Apizaco market, 1: San Antonio Coaxomulco (10 km); 2: El Carmen Xalpatlahuaya (17 km); 3: Chignahuapan (49 km); 4: Huamantla (27 km); 5: La Malinche (17 km); 6: Piedras Negras (23 km); 7: Tlaxco (24 km); and 8: Xalostoc (12 km). • = Huamantla market, 9: Ranchería La Cruz (12 km); 10: Cerro Grande (15 km); 11: Matamoros (4 km); 12: Morelos (6 km); 13: San Francisco Tetlanohcan (30 km); and 14: Los Pilares (6 km). ■ = Tlaxcala market, 15: Santa Ana Chiahutempan (3 km); 16: Calpulalpan (55 km); 17: San Mateo Huexoyucan (12 km); 18: Los Volcanes (46 km); and 19: San Simeón Xicotzingo (25 km).

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