The Grace of the Flood: Classification and Use of Wild Mushrooms among the Highland Maya of Chiapas[1]

Glenn H. Shepard Jr.[*,2], David Arora[3], and Aaron Lampman[4]

[2]Biological Sciences, University of East Anglia, Norwich, UK
[3]Department of Forest Science, Oregon State University, Corvallis, OR, USA
[4]Department Anthropology, Fort Lewis College, Durango, CO, USA
*Corresponding author; e-mail: gshepardjr@gmail.com

The Grace of the Flood: Classification and Use of Wild Mushrooms among the Highland Maya of Chiapas. The highland Maya of Chiapas in southern Mexico gather, consume, and sell a wide variety of mushrooms during the rainy season from June to November. The mushrooms are prized as a valuable source of nutrition and income, and a few species are used medicinally. No evidence exists for current or historical use of hallucinogenic mushrooms, though descriptions of mushroom intoxication suggest nonspecific knowledge about the presence of psychoactive properties in some mushrooms. Free-listing exercises elicited 50 or more mushroom names in each of the two main highland Mayan languages, Tzeltal and Tzotzil. Identification exercises using mushroom photographs permitted a preliminary assignment of mycological species, genera, or families to many of the local mushroom names collected in free-lists. Field identification during the rainy reason further emphasized the concordance of many local names with distinctive mycological groups or taxa. Mushroom sketches made by informants revealed the detailed knowledge many of the highland Maya maintain about mushroom morphology, ecology, and diversity. Mayan mushroom classification provides additional evidence for several of the universally presumed principles of ethnobiological classification. However, in contrast to their classification of plants, the Mayan system of mushroom classification is mostly concerned with edible and other useful species. (One such species, previously unknown to science, is described here.) Most species with no cultural use are presumed by the highland Maya to be poisonous and are relegated to a wastebasket category known locally as "stupid" or "crazy" mushrooms.

Key Words: *Amanita*, wild edible fungi, Chiapas, Mexico, ethnomycology, Tzeltal Maya, Tzotzil Maya, folk classification.

Introduction and Research Context

> And so it rained for thirteen days and thirteen nights. After the flood waters subsided the crops had been destroyed and there was nothing to eat, so our Lord's first act was to make the edible mushrooms grow. Mushrooms are thus *yutzil pulimal*, the "Grace of the Flood," God's first gift to Noah and his crew after suffering through the long days of rain.
>
> —excerpt from a Tzeltal Mayan story (see full text below)

While carrying out ethnomycological research in different parts of the world, one often encounters curious young Western tourists along the way. The conversation invariably comes around to the subject of one's research, followed by the predictable response: "Mushrooms? You mean, like, *magic* mushrooms?!" This is especially true in Mexico; in addition to being one of the world's most culturally and biologically diverse nations (Mittermeier et al. 1997; Loh and Harmon 2005), Mexico is also home to some of the world's most famous mushrooms. R. G. Wasson's (1957, 1961) widely-publicized rediscovery of the ritual use of *Psilocybe* spp. by several groups of Mexican Indians not only launched the field of ethnomycology but also helped spark the

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psychedelic revolution of the 1960s. The popular and scientific interest in Mexico's hallucinogenic mushrooms has generated a vast bibliography (e.g., Wasson 1962; Guzmán et al. 2000), but has tended to overshadow the comparatively small, though growing, body of literature addressing other aspects of ethnomycological knowledge in Mexico (de Avila and Guzmán 1980; Mapes et al. 1981a,b; Martinez-Alfaro et al. 1983; Gonzalez-Elizondo 1991; Laferriere 1991; Shepard and Arora 1992; Bandala et al. 1997; Hunn et al. 2000; Lampman 2004; Garibay-Orijel et al. 2007; Lampman 2007a, b; Montoya et al. 2008 and Pérez-Moreno et al. 2008, this issue).

Previous ethnobotanical research in Chiapas only barely touched on Mayan mushroom naming and classification (Berlin et al. 1974; Laughlin 1975). In fact, mycological surveys remain limited, with only 291 mushroom species identified to date, though each subsequent study adds a dozen or more new registers (Pérez-Moreno and Villareal 1988; Robles Porras et al. 2006). This study was initiated by Glenn Shepard in 1992 as a general survey of mushroom knowledge among the highland Maya. Work began during the winter dry season and, as wild mushrooms were not in evidence, Shepard developed his Tzeltal and Tzotzil language skills while making contacts with informants in widely-dispersed townships, and used published mushroom photographs to elicit preliminary information. In June the rains arrived, and so did mycologist David Arora. These two spent the following month gathering mushrooms, accompanying and interviewing Mayan mushroom hunters, and visiting local markets where mushrooms were on sale, with the intention of returning in subsequent years to intensify and broaden the research (Shepard and Arora 1992; Shepard 1993). However, the Zapatista uprising of 1994 interrupted their plans (see Shepard and Anderson 1995).

Four years later, in 1998, the highland Maya ethnomycological research project was revived by Aaron Lampman (see also Berlin 1998) in affiliation with the Maya International Cooperative Biodiversity Group (Maya ICBG), but was also cut short when the bioprospecting activities of Maya ICBG came under intense local, national, and international scrutiny (Nigh 2002; Berlin and Berlin 2003; Hayden 2003). All affiliated researchers, including Lampman, voluntarily ceased their biodiversity collection efforts.

This paper presents results of Shepard and Arora's (1992) preliminary, wide-ranging study of mushroom naming, classification, and use among the highland Maya, interpreted in light of Lampman's (2004) more intensive, geographically-focused study. One new, culturally salient species of *Amanita* (Appendix 1) is also described.

Study Area and Methods

Chiapas is a mountainous state located in southern Mexico on the border of Guatemala. With nearly one million of its inhabitants speaking an indigenous language, Chiapas stands out as one of the most culturally diverse states in a highly diverse country. The roughly 600,000 speakers of the various Tzeltal and Tzotzil dialects are scattered across 14 townships in the central highlands (Kohler 1980, 2000; INEGI 2000). Smaller communities within these townships are staunchly individualistic, asserting their identities through localized styles of clothing, religious practices, crafts, and agricultural production. Despite these differences, traditional Tzeltal and Tzotzil communities continue to engage in similar lifestyles, characterized by small-scale corn and bean swidden agriculture, the herding of sheep and cattle, and various kinds of low-income wage labor. Despite recent efforts to "modernize," Chiapas remains one of the poorest states in Mexico due to a long history of outside control of productive resources and unequal access to basic government services.

The cultural diversity of Chiapas is mirrored by its ecological diversity. The mountains range up to 2,500 meters (m), providing a wide array of microhabitats that harbor approximately 3,000 species of vascular plants and many species of vertebrates (Breedlove 1981; Rzedowski 1993; Berlin and Berlin 1996). The climate is classified as subhumid temperate, with high yearly variation in rainfall and a pronounced rainy season (Hunn 1977; Rzedowski 1993). Highland areas were once dominated by *Quercus-Pinus-Liquidambar* forests. Despite widespread disturbance due to human activities, these forests are still apparent, transitioning to tropical moist forest at lower elevations.

While highland oak and pine forests support a wide variety of ectomycorrhizal mushrooms, saprotrophic mushrooms predominate in the lower elevations transitioning to tropical forest because there are fewer ectomycorrhizal tree

hosts. Since ectomycorrhizal mushrooms tend to be large, fleshy, and appealing as food, while most neotropical saprotrophic mushrooms are too small and/or tough to tempt the palate (and are consequently less apt to form a significant part of the indigenous diet), we concentrated our investigation in the villages set amid the ectomycorrhizal forests of oak and pine.

Research was carried out with a total of 24 informants (14 male, 10 female, ages 10–60) in 6 of the 14 highland Mayan townships, covering a wide span of ecological zones and including representatives of the two major language groups: the Tzeltal-speaking townships of Oxchuc and Aguacatenango, the Tzotzil-speaking townships of Chamula, Zinacantan and Chenalho, and the mixed-language township of Pantelho (Fig. 1). Oxchuc, Chamula, and Zinacantan are found in the central highland region known locally as "cold country," while Aguacatenango, Chenalho, and Pantelho are found at transitional altitudes towards the lowland "hot country."

Free-listing exercises were carried out with 14 informants (9 male, 5 female; see Table 1), during which they were asked to name all the mushrooms they could remember (Table 1; Appendices 2 and 3). They sketched drawings of each kind of mushroom (examples are shown in Figs. 2, 3, 4, 5, 6), often drawing or describing detailed morphological features (see Table 2), as

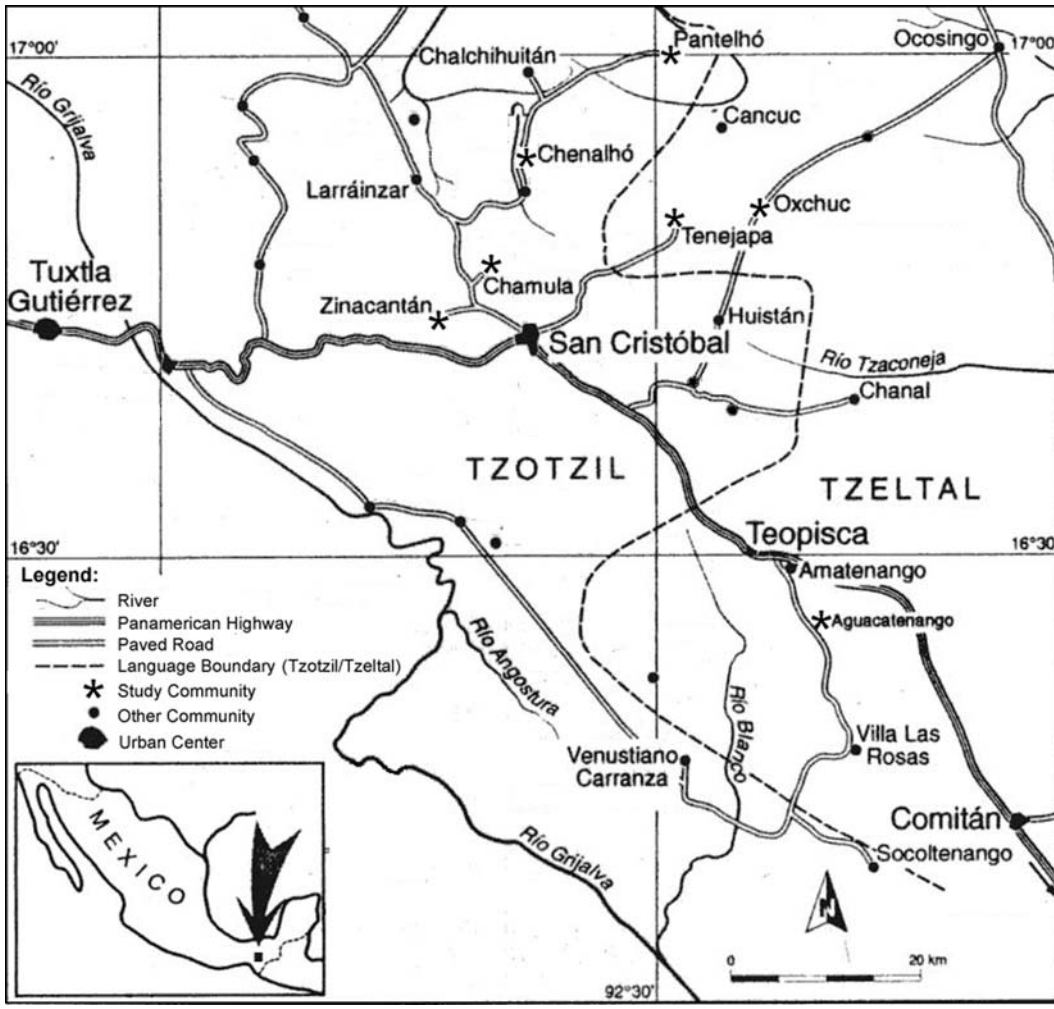

Fig. 1. Map of study region, adapted from Kohler (1980).

Table 1. Summary of informant participation in free-listing of mushroom names and photographic identification of species selected from Arora (1991); see also appendices 2–4.

Informant Initials	Sex	Age	Language (Township)	Free-List Names	Photo Exercise
SHR	F	28	Tzeltal (Aguacatenango)	20	√
FVJ	M	40	Tzeltal (Aguacatenango)	17	√
PGL	M	60	Tzeltal (Aguacatenango)	17	√
PAJ	M	45	Tzeltal (Aguacatenango)	–	√
JJR	F	45	Tzeltal (Aguacatenango)	–	√
VAH	F	55	Tzeltal (Aguacatenango)	–	√
LRM	M	11	Tzeltal (Aguacatenango)	–	√
PME	F	60	Tzeltal (Aguacatenango)	–	√
VGL	M	54	Tzeltal (Oxchuc)	24	√
MGL	F	60	Tzeltal (Oxchuc)	15	√
DGM	F	60	Tzeltal (Oxchuc)	6	√
DSG	M	40	Tzeltal (Oxchuc)	–	√
AGE	M	44	Tzeltal (Pantelho)	8	√
CE	M	40	Tzeltal (Pantelho)	7	√
XLC	M	26	Tzotzil (Chamula)	37	√
LLL	F	10	Tzotzil (Chamula)	28	–
MLC	F	35	Tzotzil (Chamula)	–	√
JPM	F	32	Tzotzil (Chamula)	10	–
DD	M	35	Tzotzil (Chamula)	6	√
ARH	M	45	Tzotzil (Chenalho)	–	√
VGD	M	(adult)	Tzotzil (Pantelho)	15	–
VSD	M	32	Tzotzil (Pantelho)	–	√
CGL	F	60	Tzotzil (Pantelho)	–	√
DSH	M	30	Tzotzil (Zinacantan)	20	√

The number in the second-to-last column indicates the number of different mushrooms named by that informant in free-listing. Check (√) in the final column indicates that the informant participated in the photographic identification exercise (Appendix 4); (–) indicates the informant did not participate in one of the two exercises.

well as place and season of growth, edibility, and whether any similar kinds of mushrooms were known under the same name. Most of the informants did not know how to read or write, and some of the older ones had never held a pen or pencil before. Nonetheless, the drawings (annotated where necessary by Shepard) demonstrate detailed knowledge of mushroom morphology and ecology (Figs. 2, 3, 4, 5, 6).

An expanded group including 21 informants (13 male, 8 female; see Table 1) were shown 62 high-quality color mushroom photographs selected from Arora's (1991) portable field guide to western North American mushrooms and asked to name the mushrooms (see Appendix 4). The field guide was especially useful because it pictured fresh mushrooms in their natural habitats, providing informants with the kind of broader visual and ecological cues (place and habit of growth, staining, etc.) they use when identifying mushrooms in the wild. Though the mushroom flora of Chiapas is different from that of western North America, most of the species depicted in Arora (1991) have closely-related, visually-similar counterparts in Chiapas, permitting informants to assign local names consistently (most of which had already been elicited in free-listing) to the photographs they viewed. Many mushroom names and species were subsequently verified in the field (see Table 3 and Appendix 4).

Mayan language terms found throughout the text are written using the standard orthographic conventions (see Berlin et al. 1974; Berlin 1992; Breedlove and Laughlin 1993), with the exception noted in Appendix 1.

During the early rainy season, daily outings were made with Mayan mushroom hunters in four of the previously-studied areas (Aguacatenango, Chamula, Oxchuc, Zinacantan) as well as to local mushroom markets. Informants were further interviewed about the names and uses of mushrooms found in the field. Mushrooms were

TABLE 2. SELECTED MUSHROOM DESCRIPTION VOCABULARY FROM AN INTERVIEW WITH A TZOTZIL-SPEAKER FROM THE TOWNSHIP OF CHAMULA.

Anatomy	
sjol	"head," cap
sba	top
yanal	"leaf," upper surface
o'lol	center
sti'il	edge
yutil	underside
yo'on	"heart," interior
yakan	"leg," stalk
ste'el	stem
svex	"skirt," ring/veil
stzek	"pants," ring/veil
yi'bil	base/volva
yisim	"hair, roots," mycelia
Size, growth stage	
muk'ul	large
bik'it	small
bik'it to	immature, still small
ch'iom to	immature, still growing (***ch'i***—to grow)
muk'ub xa	mature, full-grown
k'aal xa	old, already rotten (***k'a***—to rot)
Growth habit	
tzo'bol	growing many together
tanijem	dispersed, growing individually
pak'al	attached (to wood)
umul	sprouting (from the earth)
Form and shape	
wolwol	round like a small stone (***wol***—CL: round stone)
umul	round, recently sprouting (***um***—sprout)
balbal	cylindrical and thick (***bal***—CL: cylinder, tree trunk)
lechlech	broad and flat, leaf-like (***lech***—CL: leaf)
lechkan	bell-shaped (***lech***—CL: leaf + ***kan***—bald)
jamal	open, spread (***jam***—to spread [legs])
joyol	thin
pimil	thick
jomol	depressed in the center, funnel-like (***jom***—canoe)
pulpul	having shallow depression, like frying pan (***pul***—ceramic bowl)
pujul	empty, hollow
balajtik	separate, like spread fingers, e.g., coral mushrooms
wotzol	piled up haphazardly, like unkempt hair, e.g., morels
lislun	with hanging pieces (***lis***—pieces of dried meat hanging)
xulubtik	branched (***xulub***—animal antlers or horns), e.g., coral mushrooms
Texture	
tzotz	hard
yijil	thick and hard, shelf-like
k'unil	soft, fragile
takin	dry
takik'oxan	dry and crisp, as if toasted
bilil	slippery, wet
simsimtik	slimy (***sim***—mucus)
jotzotzet	sticky
kanal	smooth, bald
k'alajtik	scaly, peeling
silultik	striate
ch'ujtik	spotted, stained (***ch'uj***—vegetable dye)
chinchintik	warty, speckled (***chin***—measles)
tantantik	powdery
xulajtik	having uneven teeth along the edge
luchaltik	marked with concentric circles (***luch***—to embroider)
tubtub	having a hump in the middle (***tub***—hump)
mochilum	wrinkled, folded, e.g., morels
ch'och'omtik	perforated with large holes, e.g., morels
vuchajtik	loosely attached
tzotzoltik	hairy, tomentose (***tzotz***—hair)
Undersurface	
oy scharcharil	having "rattles," i.e., gills (***char***—to rattle)
t'ast'as	swollen and soft, like a fat belly (***t'as***—belly)
chiriptik	perforated with small holes, pores (***chir***—to whistle)
ch'ixch'ixtik	spiny (***ch'ix***—spine)
oy stanil	dusted with spores (***tan***—powder)
oy sch'ailal	emitting a cloud of spores (***ch'ail***—smoke)
Stem features	
nat'il	tall and thin
komkom	short and thick
yijil	thick, robust
t'omol	thick, swollen (***t'om***—to explode)
jich'il	thin, fragile
jomol	hollowed out
pujul	empty, hollow
oy sbek'etal	meaty (***bek'***—bone, body)
oy svex	"has skirt," i.e., veil, ring or volva

CL indicates numeral classifiers (see text)

TABLE 3. THE MOST SALIENT FOLK GENERA IN TZELTAL AND TZOTZIL. ENGLISH GLOSSES PROVIDED (NA: NOT ANALYZABLE; SP: SPANISH LOAN WORD).

Taxonomic Group	Tzeltal Name	Tzotzil Name	Notes on Classification
Agaricus	***yax ak*** "green grass"	***moni'*** NA	Grass-growing *Agaricus* spp.: focal species called ***nek sakil*** (Tze: true white), others (nonedible) called ***yan*** (Tze: other), ***lu' te'*** (Tze: poison), ***wixil*** (Tzo: sister), ***yat ka'*** (Tzo: horse penis)
Amanita (esp. those species closely related to *A. caesarea*)	***k'an tsu*** "yellow gourd"	***yuy*** NA	*Amanita* spp.: focal species are *A. caesarea* (sensu auct. mex.) complex and *A. hayalyuy sp. nov.* (Tzo: ***jayal yuy***: thin ***yuy***); edible species epithets include ***k'anal*** (yellow), ***tsajal*** (red), ***ijk'al/ik'al*** (black); misc. unknown/poisonous species are called ***wixil*** (sister), ***yuy angel*** (Tzo: ghost amanita)
Amanita muscaria	***slu' chawuk*** "thunderbolt mushroom," ***tsajal lu'*** "red mushroom"	***yuy chauk*** "thunderbolt mushroom," ***yuy angel*** "ghost mushroom"	Fly agaric: said to emerge where lightning strikes; known to be poisonous and to "cause drunkenness"; Tze: ***tsajal lu'*** (red mushroom) also refers to misc. inedible red species (*Russula*, *Hygrocybe*)
Amanita vaginata complex	***cholchol be'*** "lined up along the path"	***chol-chol be'*** "lined up along the path"	Grisettes (once grouped in a segregate genus, *Amanitopsis*): considered a segregate group (***sjoy***: its friend) within ***k'an tsu/yuy***; also known as ***ik'al*** (black) or ***chak xik'*** (gray) ***yuy***
Armillaria, *Lyophyllum*, etc.	***chejchew/jechew*** NA	***chechev*** NA	Broad generic concept for small, fleshy, capitate mushrooms growing in large quantities on ground or wood: folk species epithets refer to associated tree species, e.g., ***checheval chij te'*** (Tze: chechev of oak tree: prob. *Armillaria* sp.), ***k'aal te'*** (of rotten tree), ***toj*** (of pine)
Astraeus, Geastrum	***but' bak'et*** "heals flesh"	***sat pukuj*** "demon eye"	Earthstars: powdery spores applied to wounds; monotypic folk genus
Auricularia	***k'o chikin lu'/pok'o chikin*** "snail ear"	***lolo pik'*** "loose vagina"	Wood ear or "jelly ear": monotypic folk genus
Boletus, Leccinum	***pan lu'*** "bread mushroom" (Sp: *pan*)	***pancito, simita*** "bread roll mushroom" (Sp: *pancito*, *semita*)	Bolete segregate: boletes with firm, dry, plump, light-brown cap like a bread roll; no habitually named folk species; but poisonous (***lu' te', vinino***) types are known
Boletus, *Suillus*	***bonkos lu', tonkos lu'*** NA	***sekub t'ul*** "rabbit liver" ***yo'on tuluk*** "turkey heart"	Main bolete group: spongier, slimier species with darker, liver-like coloration, especially *Suillus*; species epithets include ***ijk'al/ik'al*** (black), ***tzajal*** (red, generally inedible); nonedible/poison species labeled ***bol lu'*** (Tze: crazy mushroom), ***wixil*** (sister), ***schi'il*** (Tzo: companion, friend)

Bovista, Calvatia	***p'un k'us, wus-wus lu'*** (onomatpoeia – puffing sound)	***sat pukuj*** "demon eye"	Puffballs: monotypic folk genus; edible only before spores mature; remedy for flatulence: puff spores onto anus (!)
Cantharellus, Lactarius	***k'an chay*** "yellow fish"	***mana yok*** "cat foot"	Focally chanterelles and milk caps, but also other funnel-shaped, terrestrial mushrooms with thick stems: folk species epithets include ***k'anal*** (yellow), ***sakil*** (white), ***ijk'al/ik'al*** (black), ***yaxal*** (blue: *L. indigo*), also see below ***ch'ix k'an chay*** ("spiny chanterelle," i.e., *Hydnum repandum*)
Coprinus, Stropharia, others	***yok wakash lu'*** "cow foot mushroom"	***yat ka'*** "horse penis"	Small, bell-shaped, dung-growing species, mostly considered inedible, but *Coprinus* was described by some informants as edible
Cortinarius	***osoria*** NA (Spanish loan?)	–	Distinctively purple *Cortinarius* named and considered edible only in Aguacatenango; "false" inedible species called ***wixil*** (sister), ***veneno*** (Sp: poison)
Daldinia cf. *concentrica* (Bolton) Ces. & De Not.	***t'ot' lu'*** "snail mushroom"	***t'ot'*** "snail"	Monotypic folk genus
Hydnum repandum	***ch'ix k'an chay*** "spiny k'an chay"	***ch'ix mana yok*** "spiny mana yok"	Hedgehog mushroom: has distinctive covering of soft "teeth"; considered a kind of ***k'an chay/mana yok*** (above)
Hypomyces lactifluorum (Schwein.) Tul. & C. Tul.	***chik pomil lu'*** "incense-dusted ear" ***chikin toro*** "bull ear"	***chakat'ob*** "red protuberance"	Lobster mushroom: monotypic folk genus; according to several informant descriptions, it is parasitic on other mushrooms, forming orange-red covering, likened by some to ***pom*** (*Protium*) incense powder
Lactarius indigo (see also, *Cantharellus*)	(***yaxal k'an chay***)	***yaxal vinajel*** "blue sky" ***sba vinajel*** "vault of heaven"	Indigo milk cap: also called ***yaxal*** (blue) ***k'an chay/mana yok*** (above)
Macrolepiota cf. *procera*	***parawo*** "umbrella" (Sp: *paragua*)	–	Parasol mushroom: distinctively named only in Aguacatenango, elsewhere known as ***najt'il*** (long-stemmed) ***yax ak/moni'*** (*Agaricus*)
Morchella	***jol kotz/tson kotz*** "turkey head, turkey comb"	***mochilum*** "folded, wrinkled"	Morels: monotypic folk genus
Neolentinus lepideus (Fr.) Redhead & Ginns	***tajxux*** NA ("pine+***xux***")	***tajchuch*** "pine squirrel"	Edible, wood-growing mushroom: monotypic?
Pleurotus	***sak itaj*** "white cabbage"	***sak itaj*** "white cabbage"	Oyster mushrooms: monotypic folk genus

Table 3. (Continued).

Taxonomic Group	Tzeltal Name	Tzotzil Name	Notes on Classification
Ramaria, Sparassis (*Hericium*)	***yisim chij*** "sheep beard" ***ts'ijts'im lu'*** "hairy mushroom"	***yisim chij*** "sheep beard"	Coral mushrooms: folk specific epithets ***sakil*** (white), ***k'anal*** (yellow), ***tsajal*** (red)
Ustilago maydis	***slu'il ixim, sjo' ixim*** "corn mushroom"	***stok'al ixim, sjo'jal ajan*** "storm cloud of corn, corn mushroom"	Huitlacoche or corn smut: monotypic folk genus

Field identifications by David Arora. Species authorities are only provided for those species not included in Appendix 4.

collected, photographed, and identified by Arora, and in many cases eaten.

Results

Mushroom Knowledge, Collection, and Use

Despite significant variation between individuals and between villages, knowledge about wild mushrooms among the highland Maya is generally sophisticated and widespread within the population. Men and women alike share roughly equal knowledge, while children participate in mushroom gathering and preparation activities and learn to recognize the major edible species at an early age. During the June to November rainy season in the Chiapas highlands, wild mushrooms form an esteemed and nutritionally significant part of the highland Maya diet.

The first rains often come in late May and are usually followed by the prompt appearance in local markets and on Mayan supper tables of *Neolentinus lepideus*, a wood-rotter, and several grassland *Agaricus* species. These are usually followed during the peak months of June and July by copious quantities of ectomycorrhizal mushrooms. Most prominent among these are amanitas (*Amanita*, the most highly-esteemed group of edible mushrooms), milk caps (*Lactarius*) and russulas (*Russula*), lobster mushrooms (*Hypomyces*, actually a parasite of certain milk caps and russulas), boletes (*Boletus*, *Leccinum*, *Suillus*), chanterelles (*Cantharellus*), corts (*Cortinarius*), and coral mushrooms (*Ramaria, Clavulina*). Other types, including morels (*Morchella*), appear toward the end of the rainy season or later (Fig. 6).

Although the Maya are likely unaware of the details of invisible mycelial, mycorrhizal, and reproductive processes, they clearly understand the ecological relationships between certain mushrooms and their tree hosts. For instance, Tzotzil mushroom hunters recognize that the "true" or "thick" ***yuy*** (species in the *Amanita caesarea* complex) grows near or under pine, while the related "thin" ***yuy*** (described as a new species, *Amanita hayalyuy* Arora & Shepard, in Appendix 1) is invariably found under oak. In fact, many Mayan mushroom names indicate an association with specific trees, and the names for saprotrophic mushrooms often reflect growth habit (on rotting wood, in pastureland, on stumps in agricultural fields, etc.).

Much of the mushroom gathering is done in the early morning by women and children. Many women bring mushrooms to sell in market towns such as San Cristóbal de las Casas and Comitán, while others vend along the highways. A morning of collecting during the peak of the mushroom season can yield two or three large baskets of amanitas or lobster mushrooms, the most valuable commercial species, and these can be sold in the afternoon for the equivalent of three or more days of wage labor. The highland Maya also consume large quantities of mushrooms at home. Informants repeatedly emphasized how much they appreciated them for their flavor and as a healthy source of meat-like nutrition during the rainy season, when food crops are not yet harvestable.

Not surprisingly, mushroom names vary more between townships than within them. For example, there are major variations in the mushroom names applied by Tzotzil and Tzeltal speakers, and indeed, there is significant variation in the names applied by the regional dialects of each of these languages (see Table 3, Appendices 2 and 3). But the variation in knowledge goes much deeper than names. In some instances, a mushroom that is named and eaten in one township is shunned or considered poisonous in another. The inhabitants of Oxchuc, for instance, were amazed to find that their counterparts in Aguacatenango, some 50 km away, consumed and valued *osoria*, a bluish *Cortinarius* which they considered poisonous. By the same token, the people of Aguacatenango were astonished that Oxchuqueros ate the ubiquitous, bright blue *Lactarius indigo* and lived to tell about it. Knowledge about the edibility of mushrooms can vary even within communities, with different families from the same small township making diametrically opposed claims about the edibility versus toxicity of some species of boletes (see Lampman 2004).

Despite many similarities between the mushroom flora of Chiapas and North America, the mushrooms prized by the Maya differ significantly from those most valued by Europeans and North Americans. Several mushrooms habitually listed by Western mushroom guidebooks as inedible or of unknown edibility are esteemed by the highland Maya. For instance, the Maya consume a stump-growing species of *Daldinia* cf. *concentrica*—a so-called inedible ascomycete known by Westerners as "crampballs" or "carbon balls"—as a snack when working in cornfields. Impressed by their nutty flavor, especially when lightly toasted, Arora proposed renaming them "tree truffles" (Shepard 1993). North American mushroom hunters also shun the genus *Cortinarius* for fear of difficult-to-distinguish toxic look-alikes, but the people of Aguacatenango appreciate the robust flavor of the species known as *osoria*, distinguished by its papery cuticle that peels off in layers. Another species valued by the Maya but generally ignored by Westerners is the small, leathery saprobe, *Schizophyllum commune* Fr. This species is widely eaten in Mexico, especially in the lowlands, where it is esteemed for its chewy, dry, meatlike flesh (Ruán-Soto et al. 2006); it is also widely eaten (and cultivated) in southeast Asia, but is dismissed by North American mycologists as being "too small and tough" to be edible (Arora 1986; Miller and Miller 2006).

Conversely, Western guidebooks extol the virtues of boletes and chanterelles, while the Maya typically show less enthusiasm for these mushrooms than for lobster mushrooms (*Hypomyces*) or milk caps (*Lactarius*). Western guidebooks also contain strong warnings to readers not to collect edible species of *Amanita* for fear of confusing them with poisonous or intoxicating amanitas. Yet the highland Maya, like other peoples of Mexico, prize certain *Amanita* species (particularly those in sect. Caesareae) over most other mushrooms. More than one Mayan woman was able to give a cogent discussion of the distinguishing features between the various species of *Amanita* collected in the same woods. They could point out, for instance, the "diseased" (warty or scabby) veil tissue that distinguishes the intoxicating *A. muscaria* from the edible *A. caesarea* complex (see Fig. 3, notes). Even Maya children seemed to have no difficulty in distinguishing the edible *Amanita* species.

Nonetheless, informants told us that a few highland Maya are poisoned by mushrooms every year. Generally, such poisonings occur when less knowledgeable people—whether migrants from other regions, young people, or long-term city dwellers—collect inappropriate mushrooms that others would know to avoid. One such victim-in-waiting was a taxi driver in San Cristóbal de las Casas who, to the detriment of his driving, showed great interest in the mushrooms that we had collected that day. He proceeded to inform us, with the authority of an expert, that most of the edible species in our basket were poisonous while the

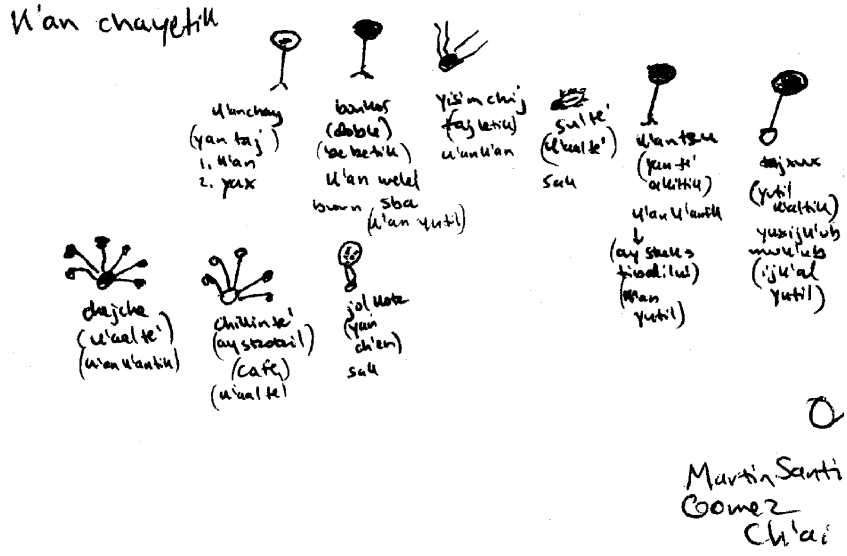

Fig. 2. Classification of mushrooms by Martin Santís Gomez, a Tzeltal speaker from Oxchuc. Note the use of the plural ***k'an chayetik*** to represent the mushroom kingdom, including nine folk generic groupings: ***k'an chay*** (in the singular, referring to chanterelles and other funnel-shaped mushrooms), ***bonkos*** (boletes), ***yisim chij*** (coral mushrooms), ***sul te'*** (shelf mushroom), ***k'an tsu*** (*Amanita*), ***tajxux*** (*Neolentinus*), ***chejche*** (*Armillaria* and similar small, yellowish species in dense groups on wood), ***chikin te'*** (wood ears), and ***jol kotz*** (morels).

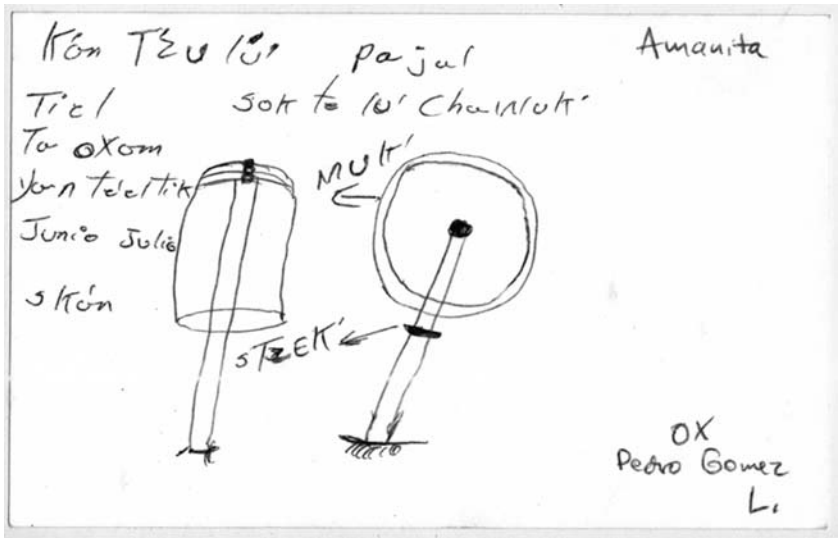

Fig. 3. Annotated drawing of ***k'an tsu lu'***, literally "yellow gourd mushroom" (*Amanita caesarea* complex) by Pedro Gomez Lopez, a Tzeltal speaker from Oxchuc. Note ring (***stzek'***), large, thick cap (***muk'***), dark central bump (umbo) on cap. Translation of Tzeltal language notes: "Edible, grows in mixed-species forests, June–July; [this is the] yellow [i.e., dark yellow to orange] species, similar to 'thunderbolt mushroom' (*A. muscaria*)."

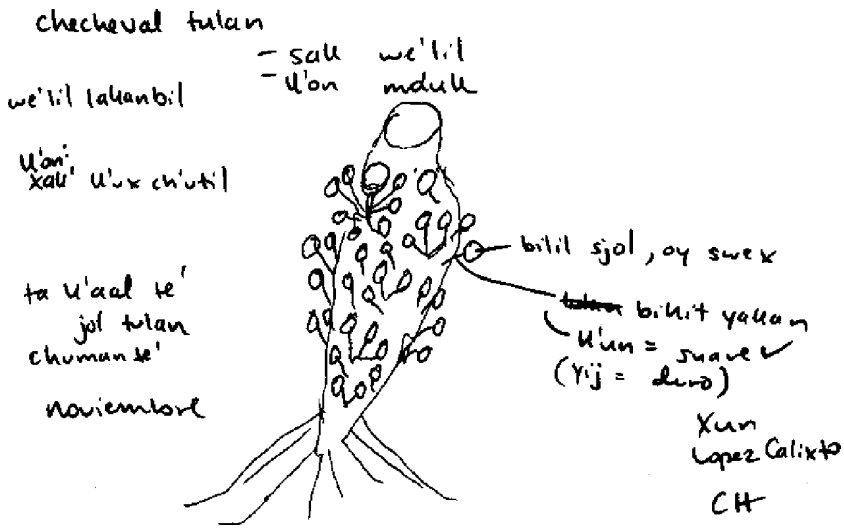

Fig. 4. Representation of ***checheval tulan***, "oak mushroom" (possibly *Armillaria mellea*) by Xun Lopez Calixto, a Totzil speaker of Chamula. Translation of Tzotzil language notes: "White [i.e., cream to light yellow] species is edible, yellow [dark yellow to orange] species not. Eaten boiled. Yellow species [possibly *Pholiota*?] causes stomach ache. Found on rotten wood, oak roots, and tree stumps, in November; cap is slick, has a ring/veil, small stem, soft."

poisonous amanitas that we had collected for study were excellent eating (see Shepard 1993).

Several mushrooms are used medicinally by the Maya. The powdery spores of puffballs and earthstars (*Lycoperdon, Bovista, Geastrum*, and *Astraeus*) are used to treat warts, wounds, and other skin conditions, as they are in many other parts of the world (Saar 1991; Benjamin 1995; Esquivel 1998). Several wood-rotting polypores, including *Ganoderma* and *Trametes*, were mentioned for treating diverse conditions ranging from stomach aches to mouth sores and insanity. It is interesting to note that similar polypores figure prominently in the traditional pharmacopoeia of China (Mizuno et al. 1995).

There is no indication for any current or historical ritual use of *Psilocybe* or any other psychoactive species among the highland Maya. Nonetheless, some of the symptoms commonly ascribed by the Maya to mushroom poisoning, e.g., references to singing, dancing, or going "crazy in the head," suggest a nonspecific knowledge about the presence of psychoactive properties in some mushrooms.

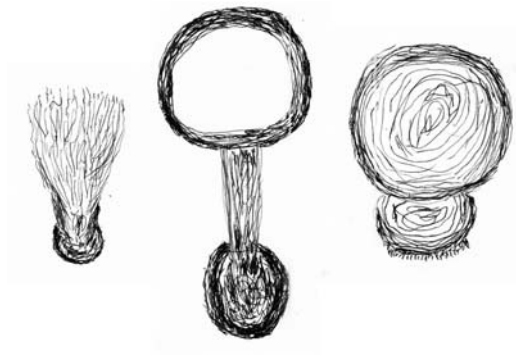

Fig. 5. A series of particularly fine drawings by Domingo Diaz, a landless, Protestant Tzotzil speaker from Chamula who had fled local religious persecution to a shanty town on the outskirts of San Cristobal. Although he scarcely knew how to read and write, his drawings show talent. Depicted are ***yisim chij*** (coral mushroom), ***yuy*** (*Amanita caesarea* complex), and ***sek'ub t'ul*** (bolete).

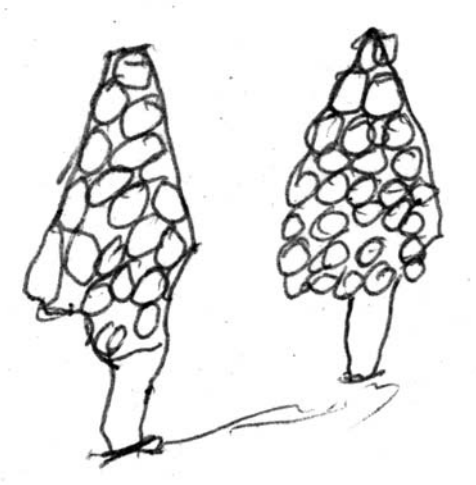

Fig. 6. Morels drawn by Juana Patixtan Mendez, a landless Tzotzil woman who did not know how to write her own name. She indicated that they were edible and grew "near caves and rocks [in February]." (Note that this represents one of the southernmost records of morel usage known to date).

A mushroom creation myth told to us by one informant (as recorded and translated in Shepard 1993) makes reference to intoxicating mushrooms, and is also notable for its syncretic imagery:

> God sent a messenger bird to warn Noah, Job, Adam, Eve, Ali Baba, and all the village elders that a flood was about to destroy the Third Creation of the World. So they built an ark and filled it with their animals and possessions. And so it rained for thirteen days and thirteen nights. After the flood waters subsided the crops had been destroyed and there was nothing to eat, so our Lord's first act was to make the edible mushrooms grow. Mushrooms are thus ***yutzil pulimal***, the "Grace of the Flood," God's first gift to Noah and his crew after suffering through the long days of rain.
>
> Soon after, however, Adam and Eve betrayed their Lord by eating the poisonous, intoxicating mushroom offered to them by the Serpent Demon. They went "crazy in the head" (***ya xbolub jolol***) and fell from the Grace of their Lord and from the Grace of the Flood. Poisonous, "crazy" mushrooms (***bol lu'***) then sprouted in the forests and fields—brothers and sisters to the original gift of edible mushrooms—and since that time mushroom hunters have had to carefully learn from their parents and grandparents which mushrooms are consecrated with the grace of God and which are the poisonous progeny of the Serpent Demon.

The account is noteworthy for its blend of Biblical and indigenous elements. For instance, the Mayan "lucky number" of 13 is substituted for the usual "forty days and forty nights" and the "Third Creation of the World" is an element of apocalyptic Mayan cosmology; there is also the juxtaposition of Noah, Adam, Eve and other mythical foreigners with the village elders; and there is the striking substitution of intoxicating mushrooms for the Biblical forbidden fruit. The story further clarifies the ineluctable association between mushrooms and the rainy season, and depicts mushrooms not only as a valued food resource, but as a divine manna, delivered by God in a time of need: a time which, as noted above, coincides with the "hunger months" before the harvest. The story also makes clear that the Maya have no need for books or field guides, and that mushroom knowledge is transmitted orally from parents and elders to children.

Tzeltal and Tzotzil Mushroom Names

In free-listing exercises (Table 1), 14 informants named, described, and sketched between 6 and 37 different kinds of mushrooms per informant (mean: 16.4). This resulted in a total sample of 55 Tzeltal and 50 Tzotzil names. The youngest informant, a 10-year-old girl, listed the second highest number of mushroom names (28), attesting to the widespread nature of mushroom knowledge and the active participation of children in mushroom-related activities.

An expanded group of 21 informants (Table 1) ascribed local names to a selection of mushroom photographs from Arora's (1991) guide to the mushrooms of the western United States (see Appendix 4). The use of photographs confirmed that many of the names elicited during free-listing refer to well-known mushrooms, and permitted the elicitation of additional names that did not appear in free-lists. Despite the obvious limitations of photographic identification, there is a high degree of similarity between the mushroom genera of North America and the highlands of Chiapas; this permitted a preliminary mycological classification of many locally-named mushrooms to scientific family or genus, and helped identify overlapping folk genera and regional cognates or variants. Combining the results of the two exercises, but excluding close synonyms and

names not mentioned independently at least twice, resulted in consensus for 38 named mushrooms in Tzeltal and 32 named mushrooms in Tzotzil (Appendices 2 and 3). By comparison, Laughlin's (1975) dictionary includes 34 Tzotzil genus-level mushroom names, while Lampman (2004) presents a more exhaustive study that includes 51 Tzeltal folk genera.

While interviewing informants, we encountered an extensive descriptive vocabulary relating to mushroom morphology, growth, and habit (Table 2; Figs. 2–4). We counted more than 100 terms that were applied to 20 or more morphological features, such as the presence or absence of a distinct cap, position of the stalk, presence or absence of gills, volva and/or grooves or lines (striations) on the edge of the cap, characteristics of the cap surface (stickiness, scaliness, etc.), odor and texture, and, of course, specific gradations of color. As already noted, the physical and temporal features of mushroom growth, including habitat and tree associates, are also frequent topics of conversation. This descriptive vocabulary is remarkably close to the macromorphological features used in scientific descriptions of mushrooms, and indicate the cultural importance of wild mushrooms in the Maya highlands and their long history of use.

Ethnomycological Classification

According to Berlin (1992), folk classification of animals and plants follows a predictable pattern across cultures, including the existence of a taxonomic structure composed of five hierarchical levels, including:

(1) the "unique beginner" or kingdom rank, reserved for a small number of highly-inclusive terms, typically "animal" and "plant";
(2) the "life form" rank, a small number of broad classes combining organisms that share basic biological features; examples in folk biological systems correspond to English-language concepts such as bird, fish, insect, tree, herb, vine;
(3) the "folk genus" rank, including the vast majority of biological taxa recognized by local peoples, often corresponding closely with scientific genera or families, e.g., oak, pine, woodpecker, trout;
(4) the "folk species" rank, representing subdivisions of folk genera, often using binomials such as white oak, rainbow trout, etc., and sometimes but not always corresponding with scientific species concepts;
(5) the "variety" rank, a further subdivision of folk species that is usually reserved for domesticated plants or animals of high cultural significance, e.g., beagle, jalapeño.

A sixth, "intermediate category" is sometimes identified at a level between the life form and folk genus in which are lumped folk genera that are morphologically or behaviorally similar, an example of which, in folk English, might be "water birds." For the most part, folk biological classification in Berlin's analysis proceeds according to perceived biological affinities among organisms, and the Linnaean system of scientific nomenclature can be seen as a natural but formal and more rigorous refinement of folk classification. Utilitarian or cultural value (edibility, material use, mythological origin), though important aspects of peoples' interactions with the biological world, are considered less important in Berlin's view than biological affinities in the recognition and naming of organisms in a natural setting.

Many theorists, however, disagree with Berlin (1992) and assert that utility is extremely important to ethnobiological systems of classification and nomenclature. These theorists assert that folk classification systems reflect a unique history of interaction with local environments and culturally-defined beliefs, behaviors, and preferences (Ellen 1979a, 1979b, 1993; Hunn 1982; see also Ellen 2008, this issue). They also note the unstable and shifting nature of folk classification systems, the idiosyncratic differences found between informants, and the numerous "special cases" found within systems of classification. What is interesting about these two theoretical approaches to understanding folk classification is that both seem to apply to Mayan ethnomycology. In other words, the Maya appear to categorize mushrooms into a shallow hierarchy based on perceived "natural" affiliations, but utility significantly affects the size and shape of the recognized mushroom domain. The following discussion will elaborate.

Kingdom. There is considerable evidence that the Maya treat mushrooms as a separate ethnobiological kingdom from animals and plants (Lampman 2007a). Perhaps the most important evidence that the Maya cognitively recognize mushrooms as a folk kingdom is linguistic. Highland Mayan languages are characterized by numeral-incorporated classifiers (Berlin 1968; Allan 1977; Shepard 1997) requiring objects to be assigned to specific perceptual categories when

counting. For example, to say "two dogs" in proper Tzeltal, the expression is ***cha-kojt tz'i'***, literally "two animals of dog," where ***cha*** is the number two, ***kojt*** is the classifier for animals, and ***tz'i'*** is the noun for dog. This contrasts with ***cha-tul winik***, "two people of men," (i.e., two men), where ***tul*** is the classifier for people.

Mushrooms do not seem to fit into the usual counting categories, and the classifiers used for mushrooms were found to vary from informant to informant. Some of the most commonly mentioned were:

kojt in Tzeltal, ***kot*** in Tzotzil ("animal")
wojt' in Tzeltal, ***wot'*** in Tzotzil ("flower")
lejch' in Tzeltal, ***lech*** in Tzotzil ("leaf")

To further highlight the uniqueness of mushrooms as a category, Laughlin (1975) notes the Tzotzil term ***chanul te'tik,*** "creatures of the forest," for mushrooms, where ***chan*** is a term referring to snakes, insects, and other generally noxious, disgusting, or useless creatures, somewhat like the colloquial English word "critter." Berlin et al. (1974) note ***ti'balil balamilal***, "meat of the earth," for mushrooms in Tzeltal. The exclusive use of the verb ***ti'***, referring specifically to the act of eating meat, confirms that as a food source, mushrooms are classified by the Maya as a kind of meat. (The verb ***ti'*** contrasts with three other verbs referring to the specific consumption of fruits versus tortillas and other bread-like foods versus beans and other crunchy foods). Considering these diverse lines of linguistic evidence simultaneously, mushrooms appear to occupy a rather ambiguous status, neither plant nor animal yet sharing characteristics of both: meaty and fleshy like animals, but fixed and rooted like plants. Western taxonomists have shared a similar ambivalence—it wasn't until the second half of the 20th century that mushrooms were formally separated from plants and placed in a separate kingdom, the Fungi.

The general, "kingdom level" term for mushrooms appears to vary considerably between townships and even between informants within townships. In Oxchuc, the general term for mushrooms appears to be ***lu'***, literally "vagina." Curiously, both Westerners and the Maya ascribe sexual connotations to mushrooms: mushroom "volvas" and "veils" reflect feminine associations, while scientific names such as *Phallus impudicus* (L.) Fr. as well as Mayan names such as ***yat ka'*** ("horse penis") and ***yat pukuj*** ("demon penis") are blatantly phallic. The association between mushrooms and sexual organs is due, in part, to concrete perceptual features: suggestive shape, fleshy consistency, and often moist or slimy texture. However these sexually-laden terms also imply a certain emotional response: depending on the conditions, context, and the passions of the moment, mushrooms can be slightly disgusting, highly desirable, or both.

In neighboring Tenejapa, ***lu'*** is apparently used in a more restricted manner to refer to poisonous mushrooms or those of unknown edibility (Lampman 2004). But in Oxchuc, ***lu'*** is clearly used to refer to mushrooms at the kingdom level, and includes edible species. For example, when naming the edible *Amanita caesarea* complex, known commonly as ***k'an tsu*** ("yellow gourd"), some Oxchuc informants noted the more complete name ***k'an tsu lu'*** (see Fig. 3), which is to say, "yellow gourd *mushroom*," emphasizing membership in the wider kingdom category of ***lu'***, or "mushrooms." Likewise, coral mushrooms, commonly called ***yisim chij*** ("sheep beard"), were referred to by some informants during free-listing as ***yisim chij lu'***, "sheep beard *mushroom*," again reinforcing the inclusive, kingdom-level nature of the term ***lu'***.

In Aguacatenango, ***lu' te'*** (literally "tree vagina") is the most common kingdom-level term for mushrooms. In Pantelho and Chenalho, Tzotzil and Tzeltal speakers use ***chikin te'*** ("tree-ear") as a kingdom-level denominator for mushrooms. As all three of these townships are located in warmer, tropical transitional areas, it is interesting to speculate that a possibly higher proportion of saprotophic, wood-growing (as opposed to terrestrial) mushrooms in the environment leads speakers to treat "tree-ears" as the most inclusive category of mushrooms.

However, some informants generalize lower-order genus-rank terms to the kingdom rank. For example, one Oxchuc informant referred to the mushroom kingdom as ***k'an chayetik*** (in the plural), and then proceeded to draw the very same ***k'an chay*** in the *singular* to represent a particular folk genus (chanterelles), followed by tiny representations of eight other distinctive folk genera ranging from boletes to amanitas to coral mushrooms to "tree ears" to morels (see Fig. 2). He clearly considered the singular form of ***k'an chay*** (which means literally "yellow fish") to be a folk

genus referring to a specific group of mushrooms, namely, funnel-shaped, yellowish mushrooms such as *Cantharellus* and *Lactarius*. But when expressed in the plural, the same term was elevated to the kingdom-level taxonomic status, intending to encompass all named mushrooms. In a similar vein, Lampman (2004) notes ***chejchew***—a Tzeltal folk genus referring to small, yellowish gilled mushrooms growing in dense clusters on wood or under trees—as the kingdom-level name for mushrooms in Tenejapa.

The Tzotzil of Zinacantan commonly use the terms ***chanul banamil*** ("creatures of the earth") or ***chanul te'etik*** ("creatures of the forest") for the mushroom kingdom. Some Tzotzil speakers of Chamula referred to mushrooms as ***chuch*** ("squirrel"): ***chuchal te'etik***, literally "squirrels of the forest"; the same usage is found in the mushroom names ***tzajal chuch*** ("red squirrel/mushroom") and ***taj chuch*** ("pine squirrel/mushroom"). However, others in Chamula used the term ***chechev*** as the kingdom-level name for mushrooms, cognate to ***chejchew*** as noted for Tenejapa.

Life Form. At the level of life form, the highland Maya appear to divide mushrooms into two broad categories according to their form and habit: (1) fleshy, terrestrial mushrooms; and (2) mushrooms that grow on trees or rotting wood and often have a woody texture and/or earlike shape. The term for the latter life-form group is almost universally ***chikin te'***, meaning "tree-ear." The term ***sul te'*** ("tree bark-layer"), usually reserved for woody species like *Trametes*, was also used more inclusively by some informants of Oxchuc as a life-form name for all "tree-ears." The life-form term ***chikin te'*** appears to represent a combination of both growth on wood and earlike shape, that is to say, with the stem of the mushroom attached laterally to the cap rather than attached umbrella-like from below. Mushrooms that are intermediate in form may be treated ambiguously. In studying the way Tzeltal and Tzotzil informants identified mushrooms from photographs, we found that not only growth on wood but also earlike shape and the absence of a clear, elongated, central stalk contributed towards the categorization of mushrooms as "tree-ears." Sometimes when looking at photographs of terrestrial mushrooms with off-center stalks (e.g. some *Cantharellus*), informants might ask, "That's growing on wood, right?" and then incorrectly identify them as "tree ears." Likewise, when looking at close-ups of wood-growing mushrooms that have a clear, central stalk and a convex or bell-shaped cap (e.g., *Pholiota*), informants often did not initially label them as "tree ears," but would sometimes change their minds after noticing the wood or stump in the photograph. Thus, central stalk and convex cap are as much the focal features of terrestrial mushrooms as their growth on the earth, while the lateral to absent stalk and earlike cap are important focal features for "tree ears" besides their growth on wood.

The term for terrestrial mushrooms at the life-form rank is highly variable from region to region and even from person to person. Sometimes the kingdom-level term for mushroom is repeated at the level of life form to refer to terrestrial fleshy mushrooms (or to exclude "tree ears"). For example, in the Tzeltal of Oxchuc, ***lu'*** refers to the mushrooms generally, but when contrasted with the term ***chikin te'*** ("tree ear"), ***lu'*** appears to refer more specifically to terrestrial mushrooms. In other cases, genus-level terrestrial mushroom terms can be used in the plural, elevating them to the life-form level of terrestrial mushrooms, and in contrast to "tree ears." Tzotzil speakers of Chamula use ***yuy*** unambiguously for *Amanita*, but by placing it in the plural, ***yuyetik***, the same term can be used to refer to terrestrial mushrooms more generally (i.e., not "tree-ears"). By the same token, ***chejchew*** and ***chechev*** (small, yellowish, tightly-clustered mushrooms under trees; see Fig. 4) and other genus names (***k'an chay***—yellowish, funnel-shaped *Cantharellus* and *Lactarius*; ***yax ak***—pasture-growing *Agaricus*) are sometimes used in the plural (***chejchewetik*** / ***chechevetik***, ***k'an chayetik***, ***yax aketik***) to refer to fleshy terrestrial mushrooms more generally.

Folk Genus. Table 3 lists some 20 of the most salient folk-genus names for mushrooms in Tzeltal and Tzotzil. Many of the names refer to clearly-defined biological groups, for example *Agaricus*, *Amanita*, boletes, morels, and puffballs. Fully 17 of 21 (86%) of the most salient Tzeltal folk genera and 17 of 19 (89%) of Tzotzil genera are composed of species belonging to a single scientific genus or family, reinforcing Berlin's (1992) claim for a universal cognitive basis for the genus level of classification in folk and scientific systems of taxonomy. Some Mayan folk genus

concepts, however, do not correspond so neatly with scientific mycological taxonomy. For example, ***k'an chay*** (Tzeltal, literally "yellow fish") and ***mana yok*** (Tzotzil, literally "cat's paw") are identical folk genus concepts in the two languages referring focally to yellowish to white, funnel-shaped mushrooms that include both *Cantharellus* and *Lactarius*, members of two distinctive mycotaxonomic orders (Cantharellales, Russulales). The hedgehog mushroom (*Hydnum repandum*) is also included at the margins of this same genus grouping as ***ch'ix k'an chay*** in Tzeltal and ***chi'x mana yok*** in Tzotzil, literally "spiny yellow fish" and "spiny cat's paw," respectively; both terms might be loosely translated as "spiny chanterelle."

While some of the Maya's taxonomic categories include unrelated mushrooms (e.g., *Lactarius, Hydnum,* and *Cantharellus*), in some cases these apparently incongruous groupings actually presage recent molecular findings. For example, Pine et al. (1999) found that *Cantharellus* and *Hydnum* (but not *Lactarius*) are closely related, though kept, for the present, in separate families. Likewise, the Maya refer to parasol mushrooms (*Macrolepiota* cf. *procera*) as "tall white Agaricus." Western taxonomists, on the other hand, used to segregate them in different families based on spore color, but now tend to agree that their phylogeny places them in a single family, the Agaricaceae.

As noted for ***k'an chay*** and ***mana yok*** (chanterelles and milk caps plus hedgehog mushrooms), many names for folk genera are cognate across the two languages: ***k'an tsu*** in Tzeltal and ***yuy*** in Tzotzil are essentially identical concepts (*Amanita*), as are Tzeltal ***bonkos/tonkos*** and Tzotzil ***sek'ub tul*** (boletes). However, some names and genus concepts are restricted to one language or the other (see Table 3). For example, ***osoria*** is a term registered only in Tzeltal-speaking Aguacatenango, referring to an edible, bluish *Cortinarius*. By the same token, the strikingly blue *Lactarius indigo* is recognized and labeled with a unique name in each of two major Tzotzil dialects as ***sba vinajel*** and ***yaxal vinajel*** (literally "vault of the sky" or "blue sky"), whereas Tzeltal speakers either do not recognize it, or classify it (somewhat correctly, from a taxonomic standpoint) as a blue variety of ***k'an chay*** (*Cantharellus-Lactarius-Hydnum*).

Drawing from the full results of the free-listing exercise (not presented here), 28 of 55 (46%) of Tzeltal genus names and 33 of 51 (65%) of Tzotzil genus names refer to the overall shape or texture of the mushrooms being named (see also Appendices 2 and 3). Many names create an analogy between some salient feature of the mushroom or mushroom group and some aspect of human, animal, or plant anatomy. Tzeltal examples include ***k'an chay*** (literally "yellow fish") for chanterelles/milk caps/hedgehog mushrooms (perhaps they resemble fish tails?), ***t'ot' lu'*** ("snail mushroom") for *Daldinia*, ***tson kotz*** ("turkey comb") for morels, ***pom chikin*** ("incense-dusted ear") for lobster mushroom, ***k'an tsu*** ("yellow gourd") for *Amanita*, and ***sak itaj*** ("white cabbage") for oyster mushroom. Tzotzil examples include ***sek'ub tul*** ("rabbit's liver") and ***sot'ot' wakash*** ("cow lung") for boletes (due to their spongy, organ-like texture), *sat pukuj* ("demon's eye") for puffballs and earthstars, and ***mana yok*** ("cat's paw") for chanterelles/milk caps/hedgehogs.

Several simple, unanalyzable expressions are also found among the folk-genus names for mushroom such as ***chejchew***, ***yuy***, ***osoria***, and ***usum*** (Table 3; Appendices 2 and 3). A smaller number of names refer to the place of growth, for example, ***chol-chol be'*** ("lined up along the path") for grisettes, and ***k'ab taj*** ("pine branch") for *Trametes* and similar bracket mushrooms. *Ustilago maydis* is a parasite of corn that is considered a delicacy in Mexican cuisine (*huitlacoche*), but bears the decidedly ignoble English name of corn smut. Its Tzotzil name is not only poetic, but encodes ecological information about its habit: ***stok'al ixim***, "storm clouds of the corn," due to its gray, billowy form and appearance during the humid rainy season in corn fields. However, the predominant trend toward emphasizing shape, texture, and general form in the naming of folk genera lends support to Hunn's (1977) observation that the recognition of folk genera is based on the "gestalt" of the organism rather than on specific sets of features.

Folk Species. Seven (about 35%) of the most salient Tzeltal and Tzotzil folk genus concepts listed in Table 3 are polytypic, i.e., they include habitually-named subgenus categories or "folk species," though the latter do not necessarily correspond exactly with scientific species concepts. This value is significantly higher than the 20% of polytypic folk genera noted for Tzeltal classification of plants (Berlin et al. 1974). The overwhelming majority (80%) of Tzeltal folk genera for plants are monotypic, that is, they contain only

one habitually named folk species (although these may encompass several biological species, which they do not differentiate by name). It appears that the overwhelming concern for utility (i.e., edibility) in Mayan mushroom classification (see below) may result in closer attention being paid to classification of mushrooms at the subgenus level when compared to plants.

As has been noted in folk biological systems throughout the world (Berlin 1992), Mayan folk species for mushrooms are named by adding descriptive epithets to the folk-genus name. The importance of color for naming folk species is notable: color terms are found in 22 of 49 (45%) habitually-named Tzeltal folk species, and 23 of 53 (43%) of habitually-named Tzotzil folk species (see Table 3). By contrast, color is incorporated into only 4 out of 38 Tzeltal folk-genus names and 3 out of 32 Tzotzil folk-genus names (about 10% each) for mushrooms (e.g., "yellow fish," "white cabbage," "blue sky," "red mushroom"; see Appendices 2 and 3).

In all Mayan folk-mushroom genera containing edible species, the prototype for the genus is a highly salient edible species. For example, the prototypical or "type" species for the Tzeltal folk genus ***k'an tsu*** ("yellow gourd") is the *Amanita caesarea* complex (see Guzmán and Ramírez-Guillén 2001), probably the most widely-eaten mushrooms in Mexico and certainly among the most available and prominent (Garibay-Orijel et al. 2007). The term ***k'an tsu*** may be used with or without a descriptive epithet to refer to this particular species group. In other circumstances, ***batz'il*** ("true") or ***mero*** (Sp: "true") may be added to emphasize its prototypical status. Folk species names are created by adding descriptive epithets, for example ***k'anal k'an tsu*** ("yellow amanita"), ***sakil k'an tsu*** ("white amanita"), ***tsajal k'an tsu*** ("red amanita"), and ***ijk'al k'an tsu*** ("black/dark amanita") (Table 3), though these terms may not be applied consistently to locally-occurring *Amanita* species by all informants. Closely affiliated to the ***k'an tsu*** genus is a group known as ***chol-chol be'*** ("lined up along the path"), which refers focally to the *Amanita vaginata* group, known in European folk taxonomy as grisettes (from French *grise* ["gray"] for their characteristic color). Some informants refer to this group alternatively as ***ijk'al k'an tsu*** ("black amanita"), reflecting a close association with the core group of amanitas. Finally, "false" species of amanitas are also distinguished, that is to say, species resembling their named, edible counterparts, but that are not (for the most part) given distinctive names and are thus considered inedible, indeed lethally poisonous. These are not usually given descriptive epithets, but rather are labeled with terms indicating marginal (as opposed to focal) status in the genus, for example ***wixil*** ("older sister"), ***bankilal*** ("older brother"), ***sjoy*** ("its friend, companion"), ***yan*** ("another"), ***amen*** ("bad"), or (as discussed below) merely ***bol lu'*** ("stupid/crazy mushroom", i.e. poisonous).

The fly agaric, *Amanita muscaria*, is a special case, however—a highly-salient species of spectacular appearance that many informants mentioned and depicted with detailed drawings in the free-listing exercise. It is universally considered among the highland Maya to be poisonous; many informants noted that it causes a drunken-like state of intoxication (***yax yakub pajal sok pox***, "It makes you drunk, like alcohol") as well as causing potential death (***yaxlaj kotik***, "It kills us"). Curiously, there appears to be no single, habitual Tzeltal name for *A. muscaria*. Some informants referred to it as ***tsajal k'an tsu*** ("red amanita"), others as ***slu' chawuk*** ("thunderbolt mushroom"; see Fig. 3 notes), and still others used descriptive terms such as ***chintik sjol*** ("with warts/measles on the cap") or ***tsajal lu'*** ("red mushroom"). Tzotzil speakers are more consistent in using the term ***yuy chauk*** ("thunderbolt amanita") or ***yuy angel*** ("ghost/angel amanita") for *A. muscaria*. In both languages, however, mushroom hunters may ignore altogether the correct genus-level classification of *A. muscaria* and call it simply ***bol lu'*** ("stupid/crazy mushroom") or ***vinino*** (Sp: "venom, poison").

Stupid Vaginas, Crazy Squirrels, and Mad Tree Ears

So far, the picture that we have painted of highland Maya mushroom classification is similar to that of Mayan ethnobotany (Berlin et al. 1974) and other systems of ethnobiological classification around the world (Berlin 1992), and also bears some similarities to the Linnaean system of scientific nomenclature. However, Mayan mushroom classification differs in one striking respect. At any point down the hierarchical process of classifying a given example of a mushroom, a Mayan speaker can "give up," as it were, on the

cognitive effort of identifying that mushroom to the folk-genus level, and proclaim, ***bol lu'***: "stupid/crazy vagina." This is roughly equivalent to an English speaker saying "toadstool," though English speakers are likely to name and recognize far fewer edible mushrooms.

Inedible, poisonous, and unknown mushrooms may sometimes be labeled as marginal "older sister/brother" (***wixil/bankilal***) members of some known genus grouping. In the case of the amanitas, poisonous and unknown species may be referred to with the same terms used for *A. muscaria*: ***yuy chawuk*** or ***yuy angel*** ("thunderbolt/ghost amanita"). But in many cases, these and other poisonous or unknown mushrooms may be lumped together in a single broad category called "stupid," "crazy," or "useless" mushrooms.

In different townships, this all-encompassing term for poisonous or inconsequential mushrooms is generally formed by adding the epithet "crazy," "poison," or "useless" to the kingdom-level term for mushroom:

Oxchuc and Tenejapa: ***lu'***—mushroom (literally "vagina") ≫***bol lu'*** (literally "stupid/crazy vagina")—any unknown mushroom, assumed poisonous

Chamula: ***chuch***—mushroom (literally "squirrel") ≫***bol chuch*** ("stupid/crazy squirrel") —any unknown mushroom, assumed poisonous

Zinacantan: ***chanul te'etik***—mushroom ("creature of the forest") ≫***tojol chon*** ("ordinary mushroom, useless creature")—any unknown mushroom, assumed poisonous

Pantelho: ***chikin te'***—mushroom ("tree ear") ≫ ***vovil chikin te'*** ("mad/rabid tree ear")—any unknown mushroom, assumed poisonous

Aguacatenango: ***lu' te'***—mushroom (literally "tree vagina") ≫also used to refer to any unknown mushroom, assumed poisonous

In some cases, the simple term ***vinino*** (Spanish loan term *veneno*, "venom, poison") is used by itself to refer to poisonous mushrooms, or added as an epithet to the name of a mushroom folk genus. When describing mushroom intoxication, informants sometimes acted out vivid pantomimes of vomiting, getting "drunk" and going crazy or rabid (singing, dancing, running naked), sticking out the tongue (the tongue is said to swell and bleed), and finally, closing the eyes to signal death. Although different kinds of poisonous mushrooms produce very different symptoms, the Maya informants interviewed tended to group and mix all these symptoms together. Thus, a mushroom that is not immediately recognized as an edible species is automatically presumed to be poisonous in all the possible ways a mushroom can be poisonous (gastrointestinal upset, psychoactive intoxication, tissue/organ damage, and death).

When walking in the forest with Mayan mushroom hunters, questions raised about miscellaneous, unknown species are mostly rejected offhand: ***bol lu'***. End of conversation. Though functionally this kind of wastebasket category is similar to the English concept of "toadstool," its cognitive associations are similar to the folk botanical term "weed," which implies both a life form (herbaceous), but also a fundamental uselessness (Hunn 1982).

It is also worth noting that the "stupid mushroom" category is dominated by small, nondescript mushrooms (see discussion about "Little Brown Mushrooms" in Arora 1986), but also includes some large and prominent species. Thus small size (see Hunn 1982) probably contributes to the likelihood of a mushroom being dismissed as "stupid" but is not the defining factor. It is also unclear whether small size contributes directly to the essence of mushroom "stupidness" or whether small size makes a mushroom less appealing as a food source, hence lowering the likelihood that it will be appreciated and named. Admittedly, it is difficult to distinguish whether terms such as ***bol lu'*** ("stupid/crazy mushroom") are indeed ethnobiological categories, or whether they represent what Berlin (1992) would call "special purpose" categories of use, or in this case, non-use.

Discussion

The Tzeltal and Tzotzil demonstrate detailed morphological and ecological knowledge about many important mushroom groups present in their environment. Their attention to macroscopic morphological details is in many ways parallel to that provided in scientific mycological descriptions. However, Mayan mushroom classification differs significantly in its scope and emphasis. The highland Maya appear to have chosen to apply their considerable observational powers, terminology, and nomenclature almost entirely to *useful* mushrooms, especially those that are edible. This focus on edibility accounts for the high proportion of useful taxa in Mayan mushroom classification, and the higher proportion of polytypic folk genera in Mayan ethnomycology compared to Mayan ethnobotany.

Only 10% of named Tzotzil and 4% of named Tzeltal mushroom folk genera contain no edible or otherwise useful species. This contrasts sharply with their classification of plants and animals, where a much larger proportion of folk genera (about 40%, according to Berlin 1992) contain culturally useless taxa. The ephemeral nature of most mushrooms, their infrequent appearance, and their bewildering diversity, especially in temperate ectomycorrhizal forests (see Luoma et al. 1997; Van de Poll 2004) may go a long way toward explaining why the highland Maya do not make the cognitive effort to classify and name a greater proportion of the mushrooms in their environment (as they do, for example, with plants), and instead relegate most of them to the dustbin category of "crazy" or "stupid" mushrooms. The ephemeral nature of mushrooms may also help to explain the significant regional and interinformant variation in mushroom nomenclature and classification: there are far fewer opportunities for individuals to "compare notes" on local mushrooms than on plants, for example.

If it is true, to paraphrase Berlin (1992), that plants and animals are classified simply "because they are there" (i.e., to satisfy intellectual or cognitive needs because they are present and salient in the environment, and not predominately due to their cultural utility), then it might be said that the highland Maya do not classify mushrooms more thoroughly "because they are not there," that is, they are only there briefly, and many species fruit only once every few years. Faced with a vast number of ephemeral mushroom species (291 documented so far, likely numbering in the thousands for all of Chiapas—see Pérez-Moreno and Villareal 1988), indigenous populations such as the highland Maya appear to focus their attention on those few, salient species that they know to be useful and consistently available.

The large category of useless, "stupid," or "crazy" mushrooms notwithstanding, the highland Maya's knowledge of edible mushrooms is impressive, and it is puzzling that this body of knowledge has been ignored by several generations of anthropologists, ethnobiologists, and mycologists. We hope this preliminary investigation will inspire more extensive studies. Historically, the literature on Mexican ethnomycology has been dominated by a focus on the spectacular use of a few hallucinogenic species by a few indigenous cultures, while native knowledge about other mushrooms and their usage and classification has received far less attention. This may say more about the investigators' interests and priorities than about those of the indigenous peoples of Mexico. The priorities of one of our Mayan informants was apparent when he accompanied us to a Tzeltal township where he had never been before. Upon arriving at the modest house of our local host, he gazed for a few moments at the nearby cornfields and pine forest, then asked three questions of her: "How do you grow such fine corn? What plants do you use for diarrhea? What kinds of mushrooms do you eat?"

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Appendix 1

A New, Culturally Salient Species of *Amanita*

During this investigation, we encountered a large, striking edible amanita that is commonly gathered, sold, and consumed in and around San Cristóbal de las Casas, but is apparently undescribed. The name applied to this species in one Tzotzil Maya dialect is ***hayal yuy*** (or ***jayal yuy***, depending on the phonetic alphabet used), meaning "thin amanita," where ***hayal/jayal*** is the adjective "thin" and ***yuy*** is the Tzotzil folk genus name for *Amanita* in general and the *A. caesarea* complex in particular. Note that there are several slightly different phonetic alphabets used to write the highland Mayan languages and dialects. Some (see Laughlin 1975) have represented the aspirate consonant with an "h" as in English, while more recent and now standardized alphabets (see Berlin 1992; Breedlove and Laughlin 1993) use the Spanish "j" (as in "Juan," "José"). In order to facilitate correct pronunciation for non-Spanish speakers, the former orthography is used to name the new species. The Tzotzil name, meaning "thin amanita," is especially appropriate because this species and many of its close relatives in stirps *Hemibapha* are slimmer and thinner-fleshed than those of stirps *Caesarea* (see below).

Amanita hayalyuy sp. nov. D. Arora & Shepard

Pileus convexus vel planus, saepe umbonatus, typice glandaceus centro fusciore et margine magis luteo et sulcato-striato. Contextus tenuis. Lamellae albae vel cremeae. Stipes typice longus, gracilis, aequalis, pallide luteolus, sub zonis fuscioribus, fibrillosisquamatis, typice annulo supero et volva ampla, alba, basali, saccata. Sporae ellipsoideae, inamyloideae, (8.6-) 9.3–11.7 (-14) × 6.2–7.8 (-9.3) µm; *Q*=1.42 (1.29–1.69, n=30, *a typo mensa*). *In terra prope quercibus, Chiapas, Mexico. Typus hic designatus*: UC 1860232 (San Cristóbal de las Casas, Chiapas).

Pileus (cap) 8–18 (25) cm, convex becoming broadly convex to plane or with slightly uplifted, often splitting margin, the center usually with a low, broad umbo at maturity (Fig. 7); color typically golden-brown or bright yellow-brown as seen from a distance but actually darker brown (or at times olive or reddish) on the disc, much brighter in the mid-portion and paler still (yellow) at the margin. Surface slightly viscid or tacky when moist, typically bald, but occasionally with a thin patch of white universal veil tissue over the center, radially sulcate-striate from the margin inward, the striations typically 1–3 cm long; margin nonappendiculate. Context whitish to pale yellow, very thin at the margin, not staining appreciably when cut; odor mild, not distinctive. *Lamellae* (gills) off-white to cream-colored or pale yellow (*not* bright yellow), close, adnexed or free to narrowly adnate, with shorter truncate gills interspersed. *Stipe* typically long and relatively slender, 15–30 cm long when mature, and generally about 1–1.5 (2) cm thick, more or less equal or tapered slightly at the top; surface yellowish or cream-colored when fresh, but frequently decorated beneath the annulus with a

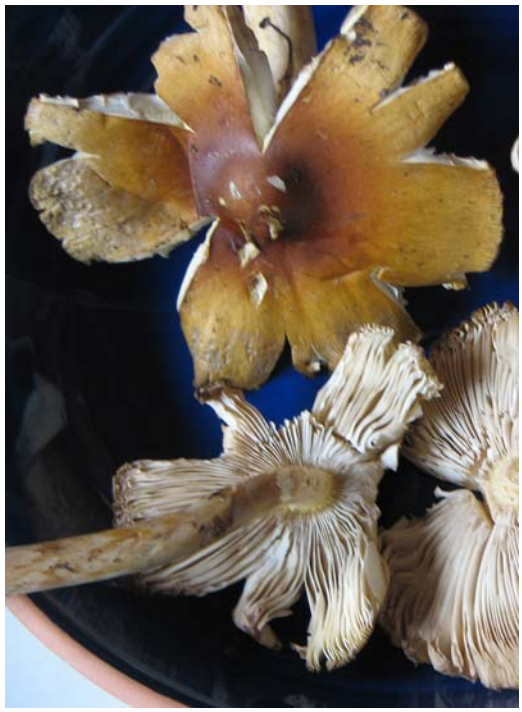

Fig. 7. *Amanita hayalyuy*, type collection showing the pale gills and broad umbo at the center of the cap. (Photo: Brent Berlin, all rights reserved).

darker orangish-brown to slightly reddish felty fibrillose layer (remnants of the inner layer of the universal veil) that frequently breaks up to form scaly, zigzagging zones (Fig. 8) around the stalk, these zones often discoloring with age or handling, and becoming duller and browner. Interior of stalk whitish to pale yellowish or cream-colored and hollow throughout or stuffed with a cottony white material. *Partial veil* typically forming a thin, superior, skirtlike yellowish annulus on the stalk that is striate on the upper surface and easily obliterated by handling. *Universal veil* white, forming an ample, sheathing, membranous, lobed saccate volva attached to the very base of the stalk; volva typically 2–5 cm high, often with a small limb ("*limbus internus*") within it at the base of the stalk, but this feature not always well-developed.

Spores white in mass; individual spores hyaline under the microscope, ellipsoid, apiculate, smooth, inamyloid, (8.6) 9.3–11.7 (14) × 6.2–7.8 (9.3) µm; Q=1.42 (1.29–1.69), n=30, as measured from the type. *Pileipellis* a trichodermium with some gelatinization at the surface. *Basidia* clavate, mostly 4-sterigmate, the bases with clamp connections. *Subhymenium* a thin (1–2 cell thick) layer of inflated cells. *Gill trama* bilateral. *Tissue of the volva* composed mainly of moderately branched, interwoven filamentous hyphae, but universal veil remnants on the surface of the stalk with large, swollen cells.

Collections Examined: UC 1860232 (holotype), bought in July in the main market of San Cristóbal de las Casas, Chiapas, by Brent Berlin, but originating in the nearby village of Chamula; UC 1860233.

Habitat and Seasonality: Solitary or in small groups, on ground near or under oaks (*Quercus* spp.) at elevations of 2,000 m. and higher; common in the mountains surrounding San Cristóbal de las Casas, Chiapas, Mexico, and especially prominent in oak forests in the vicinity of the small towns of Chamula and Teopisca. It typically fruits from June to September but is most common in late June and July.

Fig. 8. *Amanita hayalyuy* in oak woodlands near the town of Teopisca. Note the tall stature when mature and the zigzag pattern of scales on the stalk. (Photo: David Arora, all rights reserved).

Comments: *Amanita hayalyuy* is one of the most salient edible mushrooms among the Tzotzil Maya of the Chiapas highlands. Within the large genus *Amanita*, this species clearly belongs to stirps Hemibapha of Section Caesareae as per Tulloss (2008). *A. hayalyuy* is close to *A. arkansana* Rosen. of the southeastern United States, but differs in its larger, ellipsoid (rather than broadly ellipsoid) spores and more prominently umbonate pileus (Fig. 7). The cap color varies somewhat but is usually yellow-brown, being yellowest at the prominently sulcate-striate margin and often darker (more olive or reddish) toward the center. It is easily distinguished from members of the *A. caesarea* complex (see Guzmán and Ramírez-Guillén 2001) by its yellow-brown rather than red-orange cap color, and its pale (never bright yellow) gills. Typically it is also taller, slimmer, and thinner-fleshed than species in the *A. caesarea* complex (referred to by the Tzotzil as "thick ***yuy***," "true ***yuy***," "yellow ***yuy***," or merely, ***yuy***).

As there is considerable dialect variation for mushroom names, especially at the folk-species level, we expect that color distinctions (for example "red" vs. "yellow") may also be used variably by other Tzotzil speakers to distinguish between *A. caesarea*, *A. hayalyuy,* and other edible amanitas. However, ***hayal yuy*** was the only local name we encountered that referred unambiguously to this species. We did not encounter this species while in the field with Tzeltal Mayan speakers, and thus did not register a proper Tzeltal folk-species name for it, but one or more names may certainly be in use. Since *A. hayalyuy* is a prominent commercial species in markets and roadside stands throughout the highlands of Chiapas (but especially in San Cristóbal and Comitán), it would be not be surprising to find it appreciated in the neighboring highland areas of Guatemala, at least where there are oaks. The taste of the cooked mushroom is much stronger than that of ***yuy***, reminiscent of asparagus or fish. It is often roasted directly over the coals by the Tzotzil, the long stalk being used as a handle to manipulate it. It is also used in *posole* or soups, spiced with chili peppers and *epazote* (*Chenopodium ambrosoides L.).*

Appendix 2. Tzeltal mushroom names.

Criteria	Name	Gloss	Town	List Frequency	Photo Consensus	Use	Notes
Form/texture	***chik pomil lu'/pom chikin lu'; chikin toro***	incense ear mushroom (Ox); bull ear (Ag)	Ox, Ag	4	*Sarcoscypha coccinea* (4)	edible	Confirmed as *Hypomyces lactifluorum* (see Table 3); some informants applied term to the red cup fungus, *Sarcoscypha*, but in photos only
	jol kotz/tson kotz	turkey head/turkey comb	Ox, Tn*	3	*Morchella* spp. (10)	edible	Morels; see Table 3
	k'o chikin lu'/pok'o chikin	snail ear mushroom	Ag, Ox, Tn*	4	*Auricularia auricula* (10)	edible	Ear mushroom; see Table 3
	sit chij lu'	eye of deer/sheep mushroom	Ox	1	No consensus (3 mentions)	edible	Probably a puffball
	t'ot' lu'	snail mushroom	Ox, Tn*	2	No consensus (3 mentions)	edible	Confirmed as *Daldinia* cf. *concentrica* (see Table 3)
	ts'ijts'im lu'	hairy mushroom	Ox, Tn*	2	*Hericium* (3), *Ramaria* (3), *Sparassis* (3)	some edible	Coral mushroom; see Table 3
	yat ka'	horse penis	Po	1	No consensus (2 mentions for *Stropharia*)	not edible	Dung-growing species; see Table 3
	yisim chij	beard of deer/sheep	Ag, Ox	3	*Sparassis* (7), *Ramaria* (6),	edible	Coral mushrooms; see Table 3
	yok wakash lu'/yakan wakax lu'	cow foot/leg mushroom	Ox, Tn*	2	No consensus (2 mentions)	edible	Dung-growing, possibly *Coprinus*, based on drawings showing thin stem and fragile, elongated bell-shaped cap
Color (+ form)	***ch'ix k'an chay***	spiny yellow fish	Ag	0	*Hydnum repandum* (5)	edible	Hedgehog mushroom; see Table 3
	k'an chay	yellow fish	Ag, Ox, Po, Tn*	6	*Cantharellus* (15), *Lactarius* (4)	edible	Chanterelles and milk caps (plus hedgehog mushrooms); see Table 3
	k'an tsu	yellow gourd	Ag, Ox, Po, Tn*	6	*Amanita* (46)	some edible	*Amanita*, especially *A. caesarea* complex; see Table 3

Appendix 2. (Continued).

Criteria	Name	Gloss	Town	List Frequency	Photo Consensus	Use	Notes
	sak itaj	white cabbage	Ag, Ox, Po, Tn*	4	*Pleurotus ostreatus* (7)	edible	Oyster mushroom; see Table 3
	tsajal lu' /tsajal chikin te'	red mushroom/ red tree ear	Ag, Ox, Tn*	3	*Amanita* (7), *Russula* (6), *Hygrocybe* (4)	not edible/ poisonous	Misc. red species, especially *A. muscaria*; see Table 3
Habit (+ form)	***balumilal lu'***	earth mushroom	Ox, Tn*	2	No consensus (4 mentions)	some edible	Not identified, mushrooms growing low to the ground, often in gardens
	chikin te'	tree ear	Ox, Po, Tn*	1	No consensus (28 mentions)	not edible	In Oxchuc, general term for wood-growing mushrooms; in Pantelho, general term for unknown/poisonous mushrooms
	cholchol be'	lined up along the path	Ag	2	*Amanita* (10)	some edible	Grisettes; see Table 3
	k'ab taj lu'	pine branch mushroom	Ox	1	No consensus (1 mention for *Trametes*)	not edible	Not identified, possibly *Trametes*
	najk'ul lu	hidden mushroom	Ox	1	No consensus (1 mention for *Tricholoma*)	edible	Not identified
	lu' te'	tree/forest mushroom	Ag	2	No consensus (38 mentions)	not edible or poisonous	In Aguacatenango, general term for unknown/ poisonous mushrooms
	slu'il ixim; tsotsojil lu' ixim/slu' kaweyo ixim	corn mushroom; corn-hair mushroom	Ox, Tn*	4	*Ustilago maydis* (11)	edible	Huitlacoche; see Table 3
	tajxux/tajchuch	(pine + squirrel?)	Ox, Tn*	1	no consensus (18 mentions)	some edible	Grows on wood; probably *Neolentinus lepideus*; see Table 3
	sul te'	tree bark	Ox, Tn*	1	no consensus (5 mentions)	some edible	Hard, wood-growing mushrooms (e.g., *Ganoderma*, *Schizophyllum*)
	yax ak/yax akilan lu'	green grass/green grass mushroom	Ag, Ox	3	*Agaricus* (23)	edible	Pasture-growing *Agaricus* spp.; see Table 3

Non-analyzable	***bonkos lu'/bankas lu'***	NA + mushroom	Ox, Tn*	3	*Boletus* (13), *Leccinum* (6), *Suillus* (3)	some edible	Boletes; see Table 3
	chejchew/jechew	NA	Ag, Ox, Po, Tn*	5	*Lyophyllum* (10), *Cantharellus* (9), *Armillaria* (3), *Hypholoma* (3)	some edible	*Armillaria* and others; see Table 3
	osoria	NA (Sp. loan?)	Ag	2	*Lactarius indigo* (6), *Clitocybe* (3), *Tricholoma* (3)	edible	Confirmed as bluish *Cortinarius*, Aguacatenango only; see Table 3
	tex-tex lu'	NA (texture?) + mushroom	Ox	1	No consensus (1 mention for *Ganoderma*)	not edible	Shelf mushroom
	tonkos lu'/t'onkos lu'/t'on-t'on lu'	NA + mushroom	Ox, Tn*	3	*Boletus-Leccinum-Suillus* (6), *Agaricus* (5)	some edible	Probably a segregate of ***bonkos*** (boletes); see Table 3
	usum	NA	Po	1	No consensus (5)	some edible	Wood-growing mushroom, not identified
Utility	***bol lu'***	stupid/crazy mushroom	Ox, Tn*	2	No consensus (11 mentions)	poison	In Oxchuc, general term for unknown/poisonous mushrooms
	but' bak'et	flesh-healer	Ag	0	*Astraeus* (3), *Geastrum* (3), *Bovista* (2)	medicinal	Earthstars; see Table 3
	poxil tsisnatik/ p'un k'us	fart medicine/ onomatopoeia: fart sound	Ag, Po	2	*Bovista* (11), *Calvatia* (5)	edible, medicinal	Puffball, edible only before spores mature; remedy for flatulence: puff spores onto anus (!)
	wus-wus lu'	onomatopoeia: spore-puffing sound + mushroom	Ox, Tn*	3	*Bovista* (4), *Geastrum* (3)	medicinal (edible)	Puffballs; spores applied to warts; some consider young puffballs edible
Spanish loan word	***konkito***	little mushroom (Sp: *honguito*)	Po	1	No consensus (3 mentions)	some edible	Small white to yellow mushrooms

Appendix 2. (Continued).

Criteria	Name	Gloss	Town	List Frequency	Photo Consensus	Use	Notes
	pan lu', panza lu'	bread mushroom (Sp: *pan*)	Ox	1	*Boletus* (5)	edible	Boletes (incl. *Leccinum*) with firm, dry light-brown cap like a bread roll; see Table 3
	parawo	umbrella (Sp: *paragua*)	Ag	0	*Macrolepiota procera* (4)	edible	Parasol mushroom in pastures; see Table 3

Presented here are 38 Tzeltal mushroom names mentioned twice or more in free-listing or photographic identification exercise, criteria used in nomenclature, English gloss (NA: non-analyzable terms: Sp: Spanish loan words), use, frequency in free-listing ($n=8$ informants), and informant consensus in ascribing names to mushroom photographs. "Photo Consensus" column based on 587 identification events by 14 Tzeltal-speaking informants (see Appendix 4). Only Tzeltal names ascribed three times or more to a given species or species group are included. Township abbreviations: Ox (Oxchuc), Ag (Aguacatenango), Po (Pantelho). Names also noted in Lampman (2004) for Tenejapa are indicated with Tn*.

Appendix 3. Tzotzil mushroom names.

Criteria	Name	Gloss	Town.	List Frequency	Photo Consensus	Use	Notes
Form/texture	***bililux***	slippery top	Ch, Zn*	2	(No mentions)	edible	From informant descriptions and sketches, probably *Agaricus*
	jol kotz	turkey head	Co, Po	1	*Morchella* (4)	edible	Morel; see Table 3
	lolo pik'	loose, open vagina	Ch, Po	0	*Auricularia* (2)	edible	Ear mushroom; see Table 3
	mana yok/ manu yok	cat paw	Ch, Po, Zn, Zn*	4	*Cantharellus* (7)	edible	Chanterelles and milk caps (plus hedgehog mushrooms); see Table 3
	ch'ix mana yok	spiny cat paw	Ch, Zn, Zn*	0	*Hydnum repandum* (2)	edible	Hedgehog mushroom; see Table 3
	mochilum	knotted, curled	Ch	1	*Morchella* (2)	edible	Morel, synonym for ***jol kotz***; see Table 3
	sat pukuj	demon eye	Ch, Po, Zn*	3	*Bovista* (4), *Geastrum* (2)	edible	Puffballs, earthstars; edible when immature; see Table 3
	sekub t'ul	rabbit liver	Ch, Co, Po, Zn, Zn*	6	*Boletus* (16), *Suillus* (8)	some edible	Boletes; see Table 3

	sekub wakax/ sot'ot' wakash	cow's liver/ cow's lung	Ch, Zn*	2	(No mentions)	some edible	Larger boletes; see Table 3
	yat ka'	horse penis	Ch, Po, Zn*	4	No consensus (5 mentions)	not edible	Dung-growing mushrooms; see Table 3
	yat pukuj	demon penis	Ch, Po	2	*Bovista* (3)	not edible	Possibly refers to *Phallus impudicus* (L.) Fr.
	yisim chij/jol chij	beard/head of deer/sheep	Ch, Zn, Zn*	5	*Ramaria* (5), *Sparassis* (5)	edible	Coral mushrooms; see Table 3
	yo'onton tuluk/ yo'on tuluk	turkey heart	Ch, Zn, Zn*	3	No consensus (4 mentions)	some edible	Smaller boletes (*Suillus*)
	yok' sup/yok' wakax/yok' tz'i'i	cat tongue/cow tongue/dog tongue	Ch	4	(No mentions)	edible	Drawings show small teeth; probably *Hydnum repandum*
Color (+ form)	***chakat'ob***	red protrusion	Ch, Zn, Zn*	3	No consensus (1 mention for *Sarcoscypha coccinea*)	edible	Confirmed as *Hypomyces lactifluorum*; see Table 3
	sak itaj/sakil chikin te'	white cabbage/ white tree ear	Ch, Po, Zn, Zn*	4	*Pleurotus ostreatus* (3)	edible	oyster mushroom; see Table 3
	yaxal vinajel/ sba vinajel	blue sky/vault of the sky	Ch, Zn, Zn*	2	No consensus (1 mention for *Lactarius indigo*)	edible	*Lactarius indigo*; see Table 3
Habit (+ form)	***chikin te'***	tree ear	Ch, Po	4	*Ganoderma* (3), *Trametes* (3)	not edible	In Chamula, general term for woody, wood-growing mushrooms; in Pantelho, general word for unknown/poisonous mushrooms
	chol-chol be'	lined up along the path	Ch, Zn*	2	*Amanita* (2)	some edible	Grisettes; see Table 3
	k'abix toj	pine branch	Ch, Zn, Zn*	3	*Cantharellus* (2)	some edible	Not identified, possibly includes *Laccaria*
	stok'al ixim, stok'al ajan/sjo'jal ajan/chu' ixim	corn clouds/corn hair/corn growth	Ch, Co, Po, Zn	0	*Ustilago maydis* (6)	edible	Huitlacoche; see Table 3

Appendix 3. (Continued).

Criteria	Name	Gloss	Town.	List Frequency	Photo Consensus	Use	Notes
	tajchuch	pine squirrel	Ch, Po, Zn, Zn*	2	No consensus (2 mentions)	edible	Grows on wood; Laughlin (1975) lists as *Lentinus*; confirmed as *Neolentinus lepideus*
Non-analyzable	***chechev***	NA	Ch, Po, Zn, Zn*	5	*Lyophyllum* (6), *Armillaria* (5), *Hypholoma* (3)	some edible	*Armillaria* and others; see Table 3
	moni'	NA	Ch, Zn, Zn*	4	*Agaricus* (12)	some edible	Grass-growing *Agaricus*; see Table 3
	usum/kusum	NA	Ch, Zn, Zn*	2	No consensus (3 mentions for *Auricularia*, *Pleurotus*)	edible	Not identified: edible, wood-growing mushroom
	yuy	NA	Ch, Co, Po, Zn, Zn*	5	*Amanita* (26)	some edible	*Amanita*, especially *A. caesarea* complex; see Table 3
Utility	***bol chikin te'***	stupid/crazy tree ear	Co	0	*Stropharia-Psilocybe* (3), (also 2 mentions for *Amanita*)	poisonous	In Chenalho, general term for unknown/poisonous mushrooms (cognate with Tzeltal ***bol lu'***)
	jovil chikin te'	crazy tree ear	Po	0	No consensus (7 mentions)	poisonous	In Pantelho, general term for unknown/poisonous mushrooms (cognate with Tzeltal ***bol lu'***)
	yuy chauk/yuy angel	thunderbolt yuy/ ghost yuy	Ch, Zn*	2	*A. muscaria* (3)	poisonous	Fly agaric; see Table 3
Spanish loan word	***bonkiyo***	little mushroom (Sp: *bonguito*)	Co, Po	0	No consensus (4 mentions)	some edible	Miscellaneous small mushrooms
	pancito, simita	bread roll (Sp: *pancito*, *semita*)	Ch	2	*Boletus-Leccinum* (5)	some edible	Boletes (incl. *Leccinum*) with firm, dry, light-brown cap like a bread roll
	vinino	poison (Sp: *veneno*)	Ch, Po	0	No consensus (11 mentions)	poisonous	General term for poisonous mushrooms

Presented here are 32 Tzotzil mushroom names mentioned twice or more between free-listing and photographic identification exercise, English gloss (NA: non-analyzable terms: Sp: Spanish loan words), use, frequency in free list ($n=6$ informants), and informant consensus in ascribing names to mushroom photographs. "Photo Frequency" column based on 257 identification events by 7 Tzotzil-speaking informants (see Appendix 4); only names ascribed three times or more to a given species or species group are included. Township abbreviations: Ch (Chamula), Co (Chenalho), Po (Pantelho), Zn (Zinacantan). Names also noted in Laughlin (1975) for Zinacantan are indicated with Zn*.

Appendix 4. Mushrooms identified from photographs in Arora (1991).

Page	Family	Species Pictured	Closest Species Identified in Field	Tzeltal Names (n=14 informants)	Tzotzil Names (n=7 informants)
228	Morchellaceae	*Morchella elata, M. angusticeps*	*Morchella* spp.	***jol kotz*** (5)	***mochilum*** (2) ***jol kotz*** (1)
232	Morchellaceae	*Morchella esculenta*	*Morchella* sp.	***jol kotz*** (5)	***mochilum*** (2) ***jol kotz*** (2)
240	Sarcoscyphaceae	*Sarcoscypha coccinea*	–	***tsajal lu'/tsajal chikin te'*** (4) ***chikin toro*** (3)	***tzajal chikin te'*** (2)
223	Astraeaceae	*Astraeus hygrometricus*	*Astraeus hygrometricus* (Pers.) Morgan	***but' bak'et*** (3)	***sat pukuj/yat pukuj*** (2)
215	Geastraceae	*Gaestrum saccatum*	*Gaestrum* sp.	***wus wus lu'*** (3) ***but' bak'et*** (3)	***sat pukuj*** (2)
218	Lycoperdaceae	*Calvatia booniana*	*Calvatia* sp.	***p'un k'us*** (5)	NC
215–216	Lycoperdaceae	*Bovista plumbea*	*Bovista* sp.	***p'un k'us*** (10) ***wus wus lu*** (4)	***sat pukuj*** (4) ***yat pukuj*** (4)
107	Agaricaceae	*Agaricus augustus*	*Agaricus* sp.	NC	NC
121	Agaricaceae	*Agaricus bitorquis*	*Agaricus* sp.	***yax ak*** (7)	***moni'*** (2)
102	Agaricaceae	*Agaricus osecanus*	*Agaricus* sp.	***yax ak*** (6)	***moni'*** (3)
101	Agaricaceae	*Agaricus silvicola*	*Agaricus* sp.	***yax ak*** (5)	***moni'*** (3)
110	Agaricaceae	*Agaricus xanthodermus*	*Agaricus* sp.	***yax ak*** (4)	***moni'*** (3)
92	Agaricaceae	*Chlorophyllum molybdites*	–	***yax ak*** (3) ***chejchew*** (2)	***yuy*** (2) ***yat ka'*** (2)
96	Agaricaceae	*Lepiota procera*	*Macrolepiota* cf. *procera* (Scop.) Singer	***parawo*** (3) ***yax ak*** (2)	***moni'*** (2)
67	Pluteaceae/ Amanitaceae	*Amanita caesarea*	*Amanita caesarea* sensu auct. mex. (*A. basii* Guzmán & Ramirez-Guillen, *A. yema* Guzmán & Ramirez-Guillen, etc.)	***k'an tsu*** (6)	***yuy*** (4)
68	Pluteaceae/ Amanitaceae	*Amanita calyptroderma*	*Amanita* sp.	***k'an tsu*** (9) ***cholchol be'*** (2)	***yuy*** (4)
77	Pluteaceae/ Amanitaceae	*Amanita muscaria*	*Amanita muscaria* (L.) Lam.	***tsajal lu'/ tsajal chikin te'*** (4) ***k'an tsu chintik/woroxik'*** (3) ("warty *Amanita*") ***slu' chawuk*** (1) ("thunderbolt mushroom")	***yuy chauk/yuy angel*** (3) ("thunderbolt/ghost *Amanita*")

Appendix 4. (Continued).

Page	Family	Species Pictured	Closest Species Identified in Field	Tzeltal Names (n=14 informants)	Tzotzil Names (n=7 informants)
66	Pluteaceae/ Amanitaceae	*Amanita ocreata*	*Amanita* sp.	***k'an tsu*** (4) ***chol chol be'*** (2)	***yuy*** (3)
72	Pluteaceae/ Amanitaceae	*Amanita pachycolea*	*Amanita* aff. *vaginata* (Bull.) Lam.	***k'an tsu*** (7) ***chol chol be'*** (2)	***yuy*** (3)
64	Pluteaceae/ Amanitaceae	*Amanita phalloides*	*Amanita* sp.	***k'an tsu*** (7) ***chol chol be*** (3)	***yuy*** (3)
71	Pluteaceae/ Amanitaceae	*Amanita velosa*	*Amanita* sp.	***k'an tsu*** (10)	***yuy*** (4)
144	Cortinariaceae	*Dermocybe phoenicea*	–	***chejchew*** (2)	***vinino/jovil chikin te'*** (3) ("poison")
135	Cortinariaceae	*Galerina autumnalis*	–	***bol lu'/ bol chikin te'*** (3)	***vinino/jovil chikin te'*** (3)
45	Hygrophoraceae	*Hygrocybe punicea*	–	***tsajal lu'*** (5)	NC
18	Russulaceae	*Lactarius indigo*	*Lactarius indigo* (Schwein.) Fr.	***osoria*** (6) ***yaxal k'an chay*** (2)	***sba vinajel/yaxal mana yok*** (2)
15	Russulaceae	*Lactarius rubrilacteus*	*Lactarius* cf. *sanguifluus* (Paulet) Fr.	***lu' te'/veneno/bol lu'*** (5) ("poison") ***k'an chay*** (2)	NC
28	Russulaceae	*Russula emetica*	*Russula* spp.	***tsajal lu'/ tsajal chechew*** (9)	***tzajal chikin te'/ tzajal yat ka'*** (2) ***yuy chauk/tzajal yuy*** (2)
134	Strophariaceae	*Naemotoloma (Hypholoma) fasciculare*	–	***chejchew*** (3)	***chechev*** (3)
130	Strophariaceae	*Psilocybe cyanescens*	*Psilocybe* sp.	***chejchew*** (4)	***chechev*** (3) ***bol chikin te'/ vinino*** (2)
126	Strophariaceae	*Stropharia ambigua*	–	***bol lu'/lu' te'*** (3) ***yat ka'*** (1)	***yuy chauk*** (1)
125	Strophariaceae	*Stropharia rugoso-annulata*	–	***bol lu'/ lu' te'*** (3) ***tzajal lu'*** (2) ***yat ka'*** (1)	NC
82	Tricholomataceae	*Armillariella mellea*	*Armillaria mellea* (Vahl) P. Kumm., *A. tabescens* (Scop) Emel., *Armillaria* spp.	***chejchew*** (3)	***chechev*** (5)
54	Tricholomataceae	*Clitocybe nuda*	–	***yax ak*** (3) ***osoria*** (3)	NC
62	Tricholomataceae	*Lyophyllum decastes*	*Lyophyllum* spp.	***chejchew*** (10)	***chechev*** (6)
86	Tricholomataceae	*Tricholoma magnivelare*	–	***yax ak*** (3)	NC
89	Tricholomataceae	*Tricholoma zelleri*	–	***k'an tsu*** (2) ***yax ak*** (2) ***osoria*** (2)	NC

2	Cantharellaceae	*Cantharellus cibarius*	*Cantharellus* cf. *cibarius* Fr.	***k'an chay*** (9)	***mana yok*** (3)
6	Cantharellaceae	*Cantharellus tubaeformis/ C. infundibuliformis*	*Craterellus* (*Cantharellus*) sp.	***chejchew*** (9) ***k'an chay*** (2)	***k'abix toj*** (2) ***chechev*** (2)
5	Cantharellaceae	*Cantharellus subalbidus*	–	***k'an chay*** (4)	***mana yok*** (3)
12	Thelephoraceae	*Polyozellus multiplex*	–	***k'an chay*** (3) ***k'an chay*** (2)	***mana yok*** (4)
212	Gomphaceae	*Clavariadelphus truncatus, C. borealis*	*Clavariadelphus* sp.	NC	NC
208	Gomphaceae	*Ramaria sp.*	*Ramaria* spp.	***yisim chij*** (6) ***tz'ijtz'im lu'*** (4)	***yisim chij/jol chij*** (5)
209	Sparassidaceae	*Sparassis crispa*	–	***yisim chij*** (7) ***tz'ijtz'im lu'*** (4)	***yisim chij/jol chij*** (5)
199	Hericiaceae	*Hericium abietis*	*Hericium* sp.	***tzijtzim lu'*** (5) ***yisim chij*** (4)	***yisim chij/jol chij*** (4)
203	Hydnaceae	*Hydnum repandum*	*Hydnum repandum* L.	***k'an chay ch'ix*** (6)	***ch'ix mana yok*** (2)
35	Pleurotaceae	*Pleurotus ostreatus*	*Pleurotus* sp.	***sak itaj*** (7) ***taj xuch*** (3) ***usum*** (1)	***sak itaj/sak chikin te'*** (3) ***usum*** (1)
194	Ganodermataceae	*Ganoderma applanatum*	*Ganoderma* cf. *applanatum* (Pers) Pat.	***textex lu'*** (2) ***letz' letz'*** (2)	***chikin te'*** (4)
197	Polyporaceae	*Trametes versicolor*	*Trametes* spp. (probably also *Trichaptum* spp.)	***k'ab taj*** (2) ***k'aal te'/lu 'te*** (2)	***chikin te'*** (3)
159	Boletaceae	*Boletus aereus*	*Boletus* cf. *variipes* Peck	***bonkos/tonkos lu'*** (6)	***sekub t'ul*** (4) ***pancito*** (1)
154	Boletaceae	*Boletus edulis*	*Boletus edulis* Bull. & close relatives	***bonkos/tonkos lu'*** (3) ***pan lu'*** (2)	***sekub t'ul*** (5) ***pancito*** (1)
166	Boletaceae	*Boletus erythropus*	*Boletus* spp.	***tsajal bonkos lu'*** (2) ***tsajal lu*** (2) ***bol lu'*** (2)	***sekub tul pancito*** (2)
164	Boletaceae	*Boletus mirabilis*	*Boletus* sp.	***bonkos/tonkos lu'*** (6)	***sekub t'ul*** (6)
174	Boletaceae	*Leccinum manzanitae*	*Leccinum* sp.	***bonkos/tonkos*** (6)	***sekub t'ul*** (2)
169	Boletaceae	*Leccinum scabrum*	*Leccinum* sp.	NC	***pancito*** (2) ***sekub t'ul*** (1)

Appendix 4. (Continued).

Page	Family	Species Pictured	Closest Species Identified in Field	Tzeltal Names (n=14 informants)	Tzotzil Names (n=7 informants)
175	Suillaceae	*Suillus brevipes*	*Suillus* sp.	***bonkos/tonkos*** (2)	***sekub t'ul*** (4)
182	Suillaceae	*Suillus cavipes*	–	***lu' te'*** (2) ***bonkos*** (1)	***sekub t'ul*** (2)
179	Suillaceae	*Suillus umbonatus*	*Suillus* sp.	NC	***sekub t'ul*** (2)
243	Auriculariaceae	*Auricularia auricula*	*Auricularia* spp.	***pok'o chikin*** (10)	***lolo pik'*** (3) ***usum*** (2)
250	Ustilaginaceae	*Ustilago maydis*	*Ustilago maydis* (DC.) Corda	***lu' jo'*** (7) ***slu'il ixim*** (4) ***schamel ixim*** (1)	***stok'al ixim*** (2) ***sjojal ajan*** (3) ***chu ixim*** (1)

Mushroom species shown in photographic identification exercise, page number in Arora (1991), most closely-related species or genus identified in the field, and most frequently mentioned Tzeltal and Tzotzil mushroom names (closely synonymous names are separated by slash [/] and counted together). Mushroom species are organized taxonomically to highlight correspondences within folk genus concepts. Species authorities are only included for mushrooms identified in the field. (–): not identified in the field; NC: no consensus.