



A comprehensive account of *Chlorophyllum molybdites*

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Abstract. Following a generic circumscription of the genus *Chlorophyllum* Masee a detailed account of *C. molybdites* is given with particular reference to its occurrence in South Africa. Its overall distribution and its poisonous qualities are discussed, as are the symptoms and treatment.

Key words: *Chlorophyllum*; *Chlorophyllum molybdites*; False parasol; Green gill; Green-lined parasol; Mushroom poisoning.

Introduction

Chlorophyllum molybdites is a fungus, which figures prominently in the literature, but there has been controversy involving its taxonomy and toxicity. Also because of the fact that many relevant papers appear in obscure journals its reported distribution was in need of clarification. Previously its distribution, although known to be extensive, was often given in rather vague terms such as 'common throughout the tropics'. The present contribution confirming this statement, also shows it to occur in subtropical and even some temperate regions of the world. Such information, necessitating a scan of the world literature, was unavailable to most interested mycologists; hence previous work on *C. molybdites* has tended to focus on regional studies.

The present contribution attempts to give an overview of the taxonomy, distribution and toxicity of *C. molybdites*. It is also intended as a guide to medical practitioners, since symptoms, their onset and duration, are discussed along with treatment.

Description

Chlorophyllum Masee, Bull. Misc. Inf. Kew 135. 1898.

[Non *Chlorophyllum* Murrill, North American Flora 9: 172, 1910 = *Chloroneuron* Murrill]

Sporophores large, resembling those of *Macrolepiota* spp. such as *M. rhacodes* (Vitt.) Sing., initially drum-stick-like then expanded and umbrella-shaped. *Pileus* convex-campanulate, then convex, finally applanate, with or without a low obtuse umbo; surface disrupting into conspicuous scales on a white, radially fibrillose background, except in the region of the disc where it remains entire. *Lamellae* attached to a collarium around the stem apex, initially white becoming tardily blue-green or olive. *Stipe* elongate-cylindric to slightly enlarged below and with a well developed ring. *Annulus* movable, membranous, double. *Flesh* thick, white, becoming orange or reddish on bruising or on exposure. *Surface of pileus* a trichodermial palisade of long septate, thin-walled, clavate elements. *Cheilocystidia* ovoid, obpyriform or sphaero-pedunculate, thin-walled, hyaline or with dark brown contents. *Pleurocystidia* nil. *Spore-print* green, fading to dull dirty green or ochraceous on drying. *Spores* large, hyaline or very pale brownish, broadly amygdaliform with a truncate germ-pore, and with a complex dextrinoid wall, which is also orthochromatic in cresyl blue. *Hymenophoral trama* regular. *Clamp connexions* often difficult to demonstrate.

Type species: *Chlorophyllum esculentum* Masee [= *C. molybdites* (Meyer: Fr.) Masee]

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Chlorophyllum molybdites (Meyer: Fr.) Masee, Bull. Misc. Inf. Kew 136. 1898. False Parasol, Green Gill, Green-lined Parasol.

Figs. 1, 2 & 3.

Agaricus molybdites Meyer, Primitiae Fl. Esseq. 300. 1818.

Agaricus molybdites Meyer [in Fries *Epicrisis*, 13. 1838; not in Syst. Mycol. 1: 308. 1821 as sometimes cited]

Lepiota molybdites (Meyer) Sacc., Syll. Fung. 5: 30. 1887.

Mastocephalus molybdites (Meyer: Fr.) Kuntze, Rev. Gen. Pl. 2: 860. 1891.

Leucocoprinus molybdites (Meyer: Fr.) Pat., Bull. trimest. Soc. mycol. Fr. 29: 215. 1913.

Agaricus morganii Peck, Bot. Gaz. 4: 137. 1879.

Lepiota morganii (Peck) Sacc., Syll. Fung. 5: 31. 1887.

Mastocephalus morganii (Peck) Kuntze, Rev. Gen. Pl. 2: 860. 1891.

Chlorophyllum morganii (Reck) Masee, Bull. Misc. Inf. Kew 136. 1898.

Agaricus glaziovii Berk., Vid. Meddel. 1879-1880: 32. 1880.

Pholiota glaziovii (Berk.) Sacc., Syll. Fung. 5: 751. 1887.

Lepiota ochrospora Cooke & Mass., Grevillea 21: 73. 1893.

Chlorophyllum esculentum Masee, Bull. Misc. Inf. Kew 136. 1898.

Lepiota esculenta (Mass.) Sacc. & Syd., Syll. Fung. 16: 1. 1902.

Agaricus guadelupensis Pat., Bull. trimest. Soc. mycol. Fr. 15: 197. 1899.

Annularia camporum Speg., An. Mus. Nac. Buenos Aires 6: 117. 1899.

Lepiota camporum (Speg.) Speg., Bol. Acad. Nac. Cienc. Córdoba 29: 114. 1926.

? *Lepiota chlorospora* Copel., Ann. Mycol., Berl. 3: 25. 1905.

Agaricus congolensis Beeli, Bull. Soc. Roy. Bot. Belg. 61: 92. 1928.

Chlorophyllum molybdites var. *congolense* (Beeli) Heinem., Fl. Icon. Champ. Congo 16: 323. 1967.

Sporophores robust and rather thick-set, at first drum-stick-like, then expanded and umbrella-shaped. *Pileus* to 12 (-30) cm diam., convex-campanulate, becoming convex and finally appanate, with a low obtuse umbo. In the very young stage entirely dark

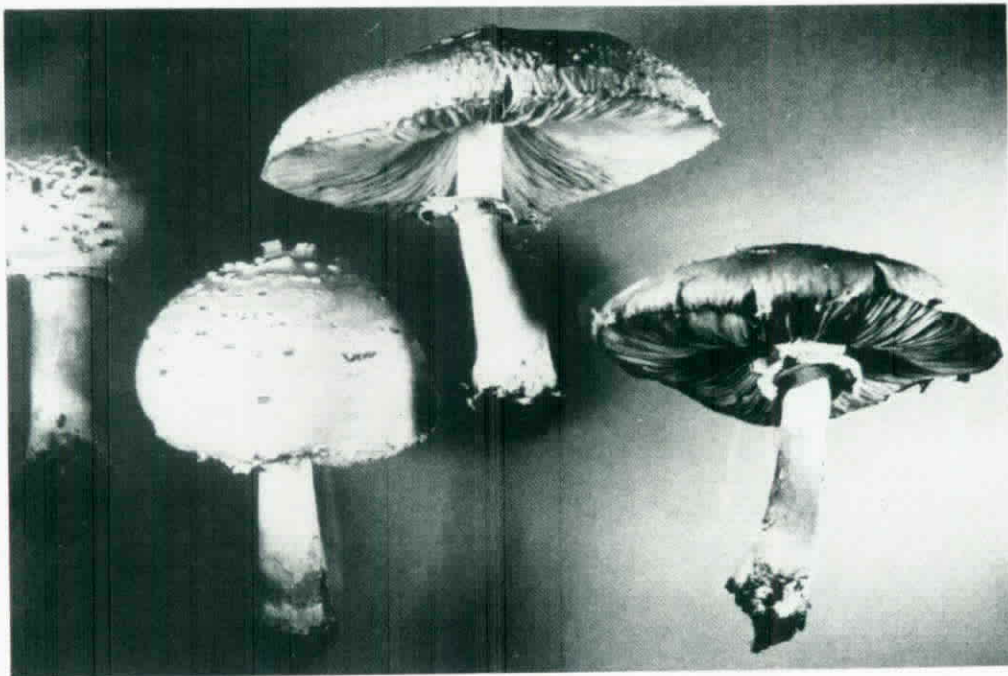


Fig. 1. *Chlorophyllum molybdites*. Basidiocarps in various stages of development.

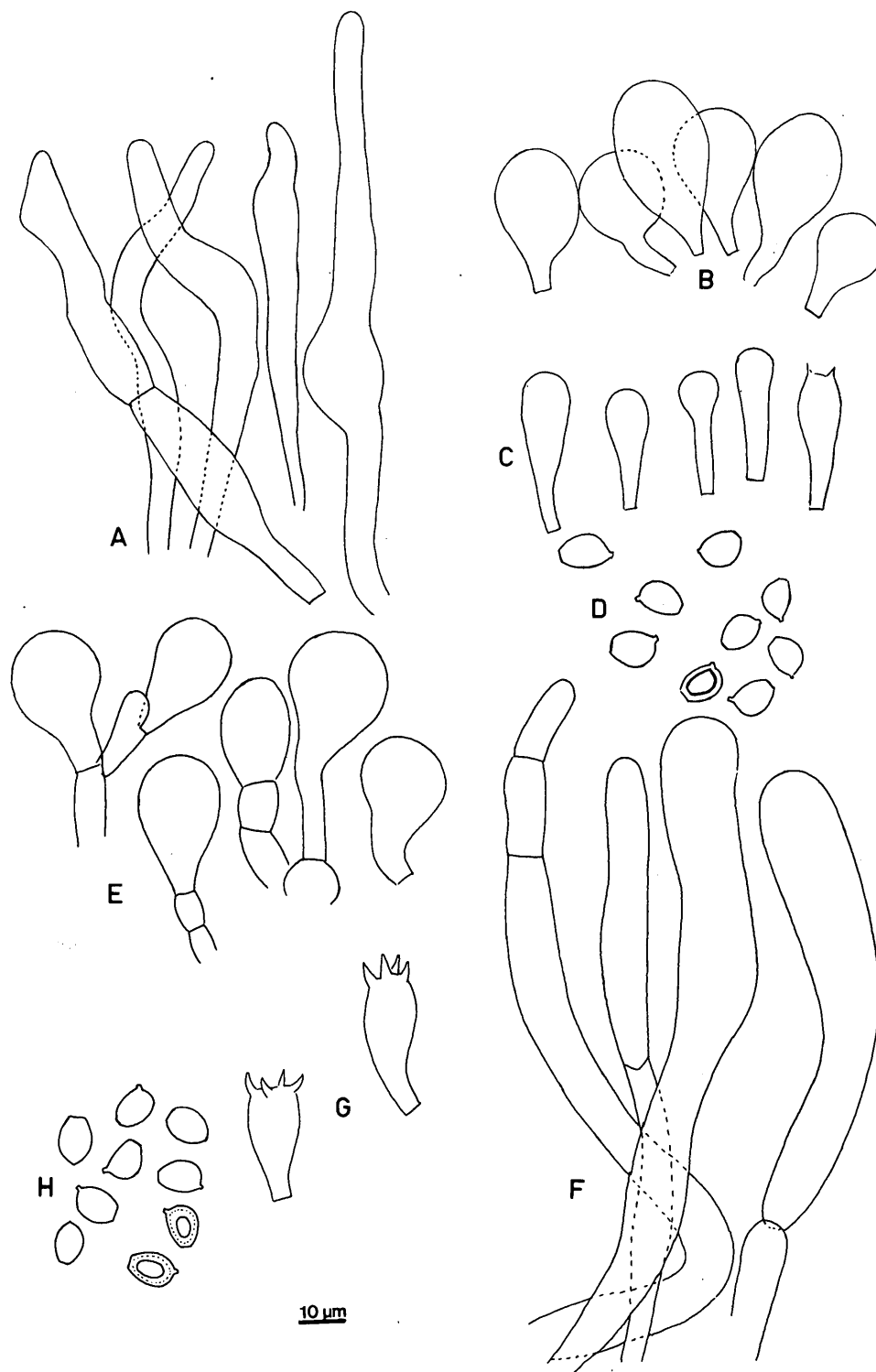


Fig. 2. *Chlorophyllum molybdites*. A-D, Microcharacters of specimen from C. L. de Villiers Sportsfield, Pretoria, 15.2.89. A, Cuticular elements from umbo; B, Cheilocystidia; C, Basidia; D, Spores. E-H, Microcharacters of specimen from Meyerton, Pretoria, 20.2.89. E, Cheilocystidia; F, Cuticular elements from umbo; G, Basidia; H, Spores. All X 666.

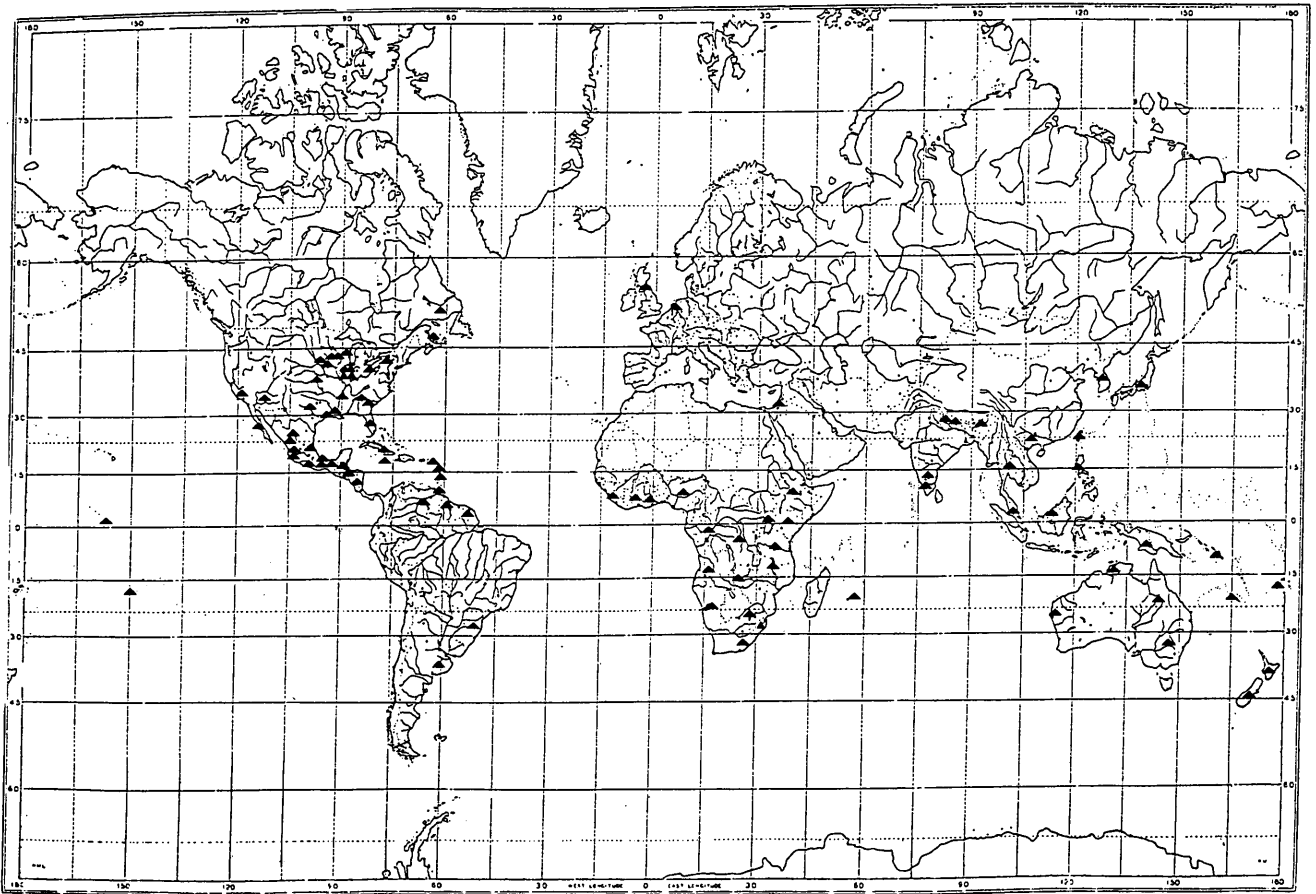


Fig. 3. Distribution of *Chlorophyllum molybdites*. Triangles indicate localities referred to in text.

brown, but with expansion of the cap, the surface rapidly disrupts except at the umbo, into large irregular dark brown scales. These scales, which often curl up at the edges, tend to be concentrically disposed, and are concentrated toward the disc, becoming more and more dispersed toward the shortly striate margin. Examination of both the umbo and these large flat scales under a lens, shows them to have a disrupted, minutely granular-punctate texture. The remainder of the pallid surface is comprised of innumerable tiny triangular, slightly darker tipped, radial fibrils. *Lamellae* of several lengths, to 1.2 cm deep, attached to a collarium around the apex of the stipe, at first white, becoming tardily blue green or olive-green; drying dirty dark yellowish olive in exsiccatae. *Stipe* to 12 (-25) cm high, to 2 (-2.5) cm wide, cylindrical, expanding only slightly to the non-bulbous base, at first white then watery streaky grey-brown, discolouring red-brown when

handled, and with a well developed ring. *Annulus* movable, membranous, double, white above with a grey-brown marginal zone below. *Flesh* white, but in the exposed socket from which the stem has been removed, becoming orange. *Surface of umbo* formed of a palisade of long, clavate, thin-walled, septate structures to 150 μm in length, and 10-16 μm in width at the apex. *Cheilocystidia* abundant, thin-walled, hyaline, ovoid, obpyriform, or sphaero-pedunculate, 25-50 \times 17-21 μm . *Basidia* 25-30 \times 10-11 μm , thin-walled, hyaline, clavate, with 4 sterigmata. *Spore print*: pale bright green, fading to dull dirty green. *Spores* 8-10 \times 6.5-7.2 μm , hyaline, broadly amygdaliform with a complex dextrinoid wall and prominent truncate germ-pore. *Hyphae* mostly devoid of clamp-connexions. *Habitat*: on lawns, playingfields, open grassland.

In South Africa. Specimens in K from *Transvaal*:

Pretoria, comm. A. A. Pearson, 1950; in open grass, L. C. de Villiers Sportsground, Pretoria, D. A. Reid and A. Eicker, 15 Feb. 1989; Meyerton, Pretoria, Prof. Robbertse, 20 Feb. 1989 [specimen forming the basis of the above account]; Tompi Seleka, College of Agriculture, Lebowa, Nebo District, J. Malan, 26 Feb. 1989.

Additional reports in the literature from Transvaal, Natal, Eastern Cape and South West Africa as follows: *Transvaal*: Pretoria or Pretoria District: Fairy Glen, Garsfontein Road, Skinner Court, Rustenburg District. Rustenburg, Zwarttruggens (Doidge, 1950, cited in literature as *Lepiota morgani*; Stephens & Kidd, 1953; Louwrens, 1964; Levin *et al.*, 1985; *Natal*: (Stephens and Kidd, 1953; Louwrens, 1964; Levin *et al.*, 1985). *Eastern Cape*: (Louwrens, 1964). *South West Africa*: (Louwrens, 1964). According to these reports it is not usually common, but may be plentiful in very wet rainy seasons, or following late summer or early autumn rains.

Distribution outside South Africa: Specimens in K from: **AFRICA**: *South West*: *Angola*: Huilla, Dr. Welwitsch (271), 8 Feb. 1860; Cazengo, Dr. Welwitsch (276), June 1855. *West*: *Nigeria*: Oil Palm Research Station, Benin, Benin Div., Benin Prov., J. M. Waterston (1034), 5 July 1948; Cowan Estate, Sepele, Jekri-Sobo Div., Warri Prov., J. M. Waterston (1035), 11 July 1948; Soil in field, Jericho, Ibadan, J. O. Eyerike (321), 11 June 1971; common in grass, Uyo, Cross River State, R. A. Nicholson (24), 10 May 1985. *Ghana*: bare soil at edge of flower bed, Tafo, Miss M. Holden (G. C. 26), 1955; the following collected by A. C. Rose on rough grassland, cut lawns, roadside verges or bare mud, Cape Coast, C. C. 7007 A-B, 25 May 1970; University College Campus, CC. 7115, CC 7115 A-C, 3-8 June 1971. *Ivory Coast*: all collected by Aké Assi: Bingerville, No. 46, June 1971; the following from Jardin Botanique de l'Université d'Abidjan, No. 127, May 1973; No. 145, 8 June 1973; No. 147, 10 June 1973; Nos. 472, 473, 15 May 1976; Nos. 474, 477, 20 May 1976; No. 17955, 12 June 1988. *Sierra Leone* Njala (Kori), F. C. Deighton (M. 2733), 7 June 1949; Njala, S. S. Monde (6, 11), 28 Oct. 1970. *East*: *Zambia* under *Pinus kesiya*, Mavekera, G. D. Pearce (F. P. 546), Feb. 1978; in maize field, Masese, Western Prov., T. T. Chitenpa (746/1/2), 28 Jan. 1983. *Malawi*: in rubbish dump and also in leafy compost in wood near Roman Catholic Cathedral, Zambo District, 2800 ft., J. Williamson (672), 15 Dec. 1973; same locality and collector as follows: Williamson (699), 23 Dec. 1973; Williamson

(717), 28 Dec. 1973; Williamson (722), 29 Dec. 1973; Williamson (770), 9 Jan. 1974; Williamson (772), 11 Jan. 1974; Brachystegia woodland, Makwawa, Zombo District 2900 ft., B. Morris (110 B), 17 Feb. 1980. *Tanzania* amongst grass, muddy sand and soil, Massazine, Zanzibar, Mrs. H. Faulkner (3145), 27 Dec. 1962; amongst grass, Sawa, Tanga District, sea level, Mrs. H. G. Faulkner (3782), 10 May 1966; University College, Dar-es-Salaam, B. J. Harris (226), Dec. 1969; Dar-es-Salaam District, J. N. R. Kasembe, Spring 1970; grassland, Sawa, Tanga District, Tanga Prov., sea level Mrs. H. G. Faulkner (4519), 10 Dec. 1970; Ukiriguru, Mwanza District, Lake Prov., 1180m, D. L. Ebbels (F. 18., F. 54), 4 March 1971; 29 Dec. 1971, same collection data Ebbels (F. 79), 23 Feb. 1973; Sewage Farm, Dar-es-Salaam University, Uzaramo District, Eastern Prov., 45m, N. Gardiner & C. M. R. Hennessy (94; 95), 28 Jan 1974; same locality: N. Gardiner (113), 7 April 1974; C. M. R. Hennessy (115), 9 April 1974. *Kenya*: amongst roadside grass, Mt Kenya, above Nyeri Station, Central Prov., 6100 ft, R. W. Rayner, 17 Nov. 1951; Nairobi, P. J. Greenway, 23 June 1952; Muguga, Kikuyu, Central Prov., M. Ivory, 5 Dec. 1969; open grass glades in *Acacia xanthophaea* woodland, Lake Naivasha, Rift Valley Prov. 6200 ft, Mrs. E. Polhill (400), 9 June 1963; same locality and collector as follows: in short grass on fringe of *Acacia* woodland, and also in thick *Pennisetum clandestinum*, Polhill (301), 23 Jan. 1970; in semi-open situation, edge of *Acacia xanthophaea* woodlands, Polhill (305), 27 Jan. 1970; amongst *Pennisetum clandestinum*, Polhill (306), 31 Jan. 1970; East Rift, N. Kinangop, 6200 ft, Polhill (21), 7 May 1968; Lake Naivasha (S. Lake, Hippo Point), Nairobi District, Rift Valley Prov., 1889m, D. N. Pegler (153), 20 March 1968. *Uganda*: moist grassland, Lake George, 1 mile South of Kasenyi, Toro District, Western Prov., J. M. Lock (14), 19 May 1969. *Ethiopia*: leaf mould under trees, Gambela, Illubabore Prov., J. W. Ash (529), 16 June 1970; Lake Sholla, J. W. Ash (1721), 24 June 1972; discontinuous ring on ground, 8 km west of Swedish Point, Arussi area, Shoa Prov., J. W. Ash (2024), 15 July 1973; Radio Voice of the Gospel Compound, Southern Addis Ababa, Shoa Prov., Hugh Pain (Ash 3579), 8 July 1976. **MIDDLE EAST**: *Israel*: Z. Avizohar-Hershenson, 3 Sept. 1958. *Melanesia*: *Mauritius*: Reduit, A. Peerally, June 1984. **ASIA**: *India*: Kerala State: Calicut, Prakasan (355), 3 May 1980; Chandigarh, S. Arya (1/77), 10 July 1977; Bihar State, Mohalla Bhagalpur, M. H. S. John

(29), 3 Aug. 1978; West Bengal: Kalyani Dt. Nadia, C. R. Mehera, 21 Jan. 1968; Calcutta, Amlan Aich (97), Feb. 1976; Calcutta, N. Samajpati (44/78, 45/78), 26 June 1978; (58/78), 17 July 1978; Paraganas, Rajpur; Tapati Mondal (M2), 15 July 1980. *Bhutan*: Thimphu, W. T. H. Peregrine (SIB 219), Feb. 1985. *Nepal*: Lalitpur, Miss Bunu Pundey (57), 1 Aug. 1974. *Malaysia*: Kuala Lumpur, 1948 (IMI 24673); rotting compost, M. S. Jangi, 13 Oct. 1985; K. M. Graham, Oct. 1986. *Thailand*: Soil under *Citrus* sp. Eangwat Lamphun, Amphol Muang, T. Schumacher & K. Hoiland, 24 June 1978. *Christmas Island* (Indian Ocean): Drumsite, in cleared area, D. A. Powell (680), 4 Aug. 1983; South Point Terrace, D. A. Powell (786), 10 Oct. 1984. *Brunei*: on buffalo dung, W. T. H. Peregrine (SIB 1040); on lawn, W. T. H. Peregrine (SIB 739), 13 Nov. 1971. *Philippine Islands*: T. H. Quimio (7393), 16 Aug. 1976. **AUSTRALASIA**: *Australia*: *Western Australia*: On watered lawns, Gasgoyne river, Agricultural Research Station, Carnarvon, A. Young 18 May 1971. *Queensland*: Camp Mountain, F. J. Considine (28, 38) 2 March 1939, 25 March 1939; F. J. Considine, unlocalized Nov. 1940; F. J. Considine (103), received 1940; Botanic Gardens, Brisbane, J. E. C. Aberdeen (1317), 23 Feb. 1953; University grounds, St. Lucia., Brisbane, J. Peberdy (64/86), 13 April 1964. On lawn Rockhampton, R. Owens, Nov. 1986. *Papua New Guinea*: in mud under No. 2 staff house, Lae Township, Mrs. M. E. Brown (5081), 12 Sept. 1967, litter at base of *Araucaria cunninghamii*, Manki logging area, Bulolo subdistr., Morobe Distr., 2500 ft. alt., Miss P. A. Wright (933), 8 Sept. 1968; Port Moresby, coll. D. Shaw & A. Williams (6288), 20 Nov. 1968; Chester Street, Port Moresby, D. Shaw (6301), 28 Nov. 1968; Konedobu, D. Shaw (6358), 18 Jan. 1969; on lawn in rings, Port Moresby, T. V. Price, 9 March 1975; garden lawn, Konedobu, B. N. Muthappa, Jan. 1984; *British Solomon Islands*: *Guadalcanal*: Dodo Creek Research Station, J. V. Jackson (G23), Nov. 1977. *New Caledonia* on pastureland, Dumbea, B. Huguenin (NC 65001), 25 Feb. 1964. *Fiji*: Eastern side of Viti Levu, C. C. M. Griffin (23), Feb. 1982.

SOUTH AMERICA: *Brazil*: Rio de Janeiro, Glaziou (9144); also (8558) [holotype of *Ag. glaziovii*]; Recife, Matadouro de Beberibe, O. Soares, 18 June 1954. *Guyana*: coastlands, on the ground, Jenman (6359), Jan. 1892; same data, No. 6426, July 1892 [Syntypes of *L. ochrospora*]; coastal pastures, Jeman (6166), May 1896

[holotype of *C. esculentum*]. *Venezuela*: Ex Herb. Berkeley. **CENTRAL AMERICA**: *Trinidad* R. E. D. Baker (1486). *Martinique*: common all year, especially on lawns and savanah, J. P. Fiard (25), 1974. *Honduras*: La Flecha, N. S. Metes (187), 9 Sept. 1973. *Belize*: J. N. Hedger, Oct. 1966. **NORTH AMERICA**: *United States*: *Texas*, A & M College Campus, H. Thiers (1383) 1953. *Louisiana*: Tulane University Campus, D. A. Reid, 17 Aug. 1967; 18 Aug. 1968. *Florida*: Gainesville, R. Singer, 16 May 1943; W. I. Illmann (45127), 5 Sept. 1954; D. A. Reid, Sept. 1977; On lawn, Altamonte Springs, Seminole Co., P. A. Schallert, 6 July 1958. *Ohio*: Dayton, A. P. Morgan, 13 Oct. 1879 [authentic for *Ag. morgani* Peck but not the holotype as the epithet was published in March 1879]. There is also a copy of 'a rough oil painting by Mr. Morgan'. *Illinois*: pasture, Geneseo E. T. & S. A. Harper, July 1898. *Kansas*: Fungi Columbiani 1301, E. Bartholomew, 1898. *Canada*: *Quebec*: near Aylmer, D. D. McArthur (63893), 2 Sept. 1959 (Det. J. W. Groves).

There are also reports from the literature as follows: **AFRICA**: *West and Central*: (Zoberi, 1972). *Zaire*: (Beeli, 1928- description of *Agaricus congolensis*; Heinemann, 1968) *Congo*: (Singer, 1969). *Ghana*: (Holden, 1970). *East*: *Zambia*: (Pierce, 1977; 1981; Pierce in Storrs and Pierce, 1982; Pegler and Pierce, 1980). *Malawi*: (Morris, 1987). *Tanzania*: (Pegler, 1977). *Kenya*: (Charters, 1960; Pegler, 1977; Pegler and Rayner, 1969). *Uganda*: (Pegler, 1977). *Ethiopia*: (Ash, 1976). *Indian Ocean*: *Mauritius*: (Peerally and Sutra, 1972). **ASIA**: *Middle East*: *Israel*: Avizohar-Hershenzon, 1967; Heinemann, 1968; Binyamini, 1975) *India*: *General* (Manjula, 1983; Purkayastha and Chandra, 1985). *South*: Tamil Nadu State (Manjula, 1980; Natarajan and Manjula, 1981; Natarajan and Kaviyarasan, 1991). *West*: Maharashtra (Desai, 1947; Sathe and Pahalkar, 1976; Sathe and Deshpande, 1980). *North*: Uttar Pradesh (Singh and Mehrotra, 1974; Ghosh *et al.*, 1976). *Malaysia*: Selangor (Pegler, 1986). *Thailand*: (Cansrikul, 1977; Hoiland and Schumacher, 1982). *Vietnam*: Tonkin (Patouillard, 1913). *Brunei*: (Peregrine and Ahmad, 1982; Pegler, 1986). *Philippine Islands*: (Reinking, 1921): Luzon: (Copeland, 1905- description of *L. chlorospora*; Graff, 1913; 1914; 1927; Theodoro, 1937; Quimo, 1983). *Christmas Island*: Indian Ocean (Pegler, 1956). *Taiwan*: (Chen, 1987). *Korea*: (Lee and Rhee, 1958). *Japan*: (Kawamura, 1954; Ito, 1959; Ohasi, 1971; 1978; Hongo,

1986; Imazeki and Hongo, 1987; Imazeki *et al.*, 1989). *Russia*: Far Eastern USSR: Primorsk krai (Wasser, 1985; Wasser and Zakordonets, 1986) *Tahiti*: (Parks, 1926; Graff, 1927). **AUSTRALASIA**: *General*: Throughout Australasia (Pegler, 1986). *Australia*: Queensland: common in Brisbane..., it has been recorded for all Queensland coast. (Aberdeen, 1979; Young, 1982); Blackbutt and Nanango (Young, 1989) New South Wales: Sydney (Young, 1989). Northern Territory: Darwin (Young, 1989). Western Australia: Carnarvon (Hilton, 1982; Young, 1989). *New Zealand*: (Wasser, 1985; 1986). **SOUTH AMERICA**: *Argentina*: Central and Northern. Provinces of Buenos Aires, Cordoba and Tucuman (Spegazzini, 1899—description of *L. camporum*; 1926; Martinez, 1948; Singer, 1969; Singer and Digilio, 1951). *Brazil*: Southern and Eastern Central including provinces of Santa Catarina, Rio de Janeiro, Sao Paulo (Fries, 1838; Berkeley, 1880—description of *Agaricus glaziovii*; Bresadola, 1896; Grandi *et al.*, 1984). *French Guiana*: (Floch, 1965). *Guyana*: (Meyer, 1818—description of *Agaricus molybdites*; Cooke—1893 description of *Lepiota ochrospora*; Masee, 1898—description of *Chlorophyllum esculentum*; Graff, 1927). *Venezuela*: (Dennis, 1970). *Trinidad*: Murrill, 1911; Baker and Dale, 1951; Dennis, 1952). **CENTRAL AMERICA**: *Costa Rica* (Rowlee, 1924). *Grenada*: (Murrill, 1911). *Bahamas*: Cat Island (Murrill, 1911, 1919). *Martinique*: (Duss, 1903; Pegler, 1983). *Guadeloupe*: (Patouillard, 1899 description of *A. guadelupensis*; Duss, 1903). *Jamaica*: (Murrill, 1911). *Cuba*: (Kreisel, 1970). *Mexico*: (Perez-Silva *et al.*, 1970), also from the following states: Chiapas (Guzman and Johnson, 1974; Perez-Moreno and Villarreal, 1988). Oaxaca and Vera Cruz (Welden and Guzman, 1978; Davalos and Guzman, 1979); Morelos (Portugal *et al.*, 1985). Mexico (Zarco, 1986; Perez-Silva and Aguirre-Acosta, 1986; Chio *et al.*, 1989). Hidalgo (Frutis and Guzman, 1983). Jalisco (Guzman and Garcia Saucedo, 1973; Manzi, 1976; Davalos *et al.*, 1983). Zacatecas (Acosta and Guzman, 1984). San Luis Potosi (Guzman, 1961; 1963). Baja California (Guzman, 1961; 1963; Ayala and Guzman, 1984). **NORTH AMERICA**: *United States*: widely distributed South and West of a line passing through the states of New York, the states bordering the Great Lakes, Wisconsin, Iowa, Nebraska, Colorado, Arizona and California as far north as Oroville; becoming more frequent in the Southern States. (Lloyd, 1898; Chesnut, 1900; McIlvaine, 1900; Atkinson, 1901; Morgan, 1907; Moffat, 1909; Murrill,

1910; 1911; 1914; 1949; Singer, 1946; Smith, 1949; 1963; 1975; Smith and Weber, 1985; Stubbs, 1971; Miller, 1972; Orr and Orr, 1979; Ammirati *et al.*, 1985; McKnight and McKnight, 1987; Huffmann *et al.*, 1989). Records from individual states include the following: District of Columbia (Ford and Clark, 1914); Ohio (Peck, 1879—type of *Ag. morgani*; Morgan, 1883; Hard, 1908; Ford and Clark, 1914; Wolf and Wolf, 1947); Michigan (Lloyd, 1899; Kauffmann, 1918; 1924; Bessey, 1939; Smith, 1954); Indiana (McIlvaine, 1900; Moffat, 1909); Illinois (Dennis, 1952); Iowa (Martin, 1937); Kentucky (Overholts and Overholts, 1916); Missouri (Webster, 1915); Kansas (McIlvaine, 1900; Bartholomew, 1927); Oklahoma (Levetin *et al.*, 1990); Tennessee (Hesler, 1960; Petersen, undated; Heinemann, 1968; Sundberg and Richardson, 1980); Georgia (McIlvaine, 1900; Hanlin, 1966). Florida (Murrill, 1937; 1949; Singer, 1946; Dennis, 1952; Weresub, 1971). Mississippi (Weresub, 1971); Louisiana (McIlvaine, 1900); Texas (McIlvaine, 1900; Weresub, 1971) California (Smith, 1936; Horne and Condit, 1941; Weresub, 1971; Sundberg, 1971; Thiers and Thiers, 1976; Arora, 1979). *Canada* (Gussow and Odell, 1927; Groves, 1972). Uncommon to rare in the Great Lakes region and south-eastern Canada (Ammirati *et al.*, 1985). Quebec (Weresub, 1971). Ontario (Dearness, 1927; Pomerleau, 1980).

EUROPE: Previous records are of specimens growing under glass (Singer, 1946); the most recent report being from the Netherlands (Vellinga, 1990). However, Watling (1991) has published an account of a British collection from Edinburgh, which comprised hundreds of basidiomes growing amongst compost in a bed of exotic ornamental plants. It would seem, therefore, that in Europe, *C. molybdites* is an alien species which occurs sporadically as the result of chance introduction, usually under glass or very occasionally exotic plants in gardens. However, in view of its having become an established component of the agaric flora of Israel following similar accidental introduction, it could well colonize warmer regions of central and southern Europe.

Illustrations

Coloured illustrations are to be found in Ammirati, Traquair and Horgen (1989) Pl. 207; Binyamini (1975) Pl. 51; Bottomley and Talbot (1953) p. 27; Dennis (1970) Pl. 10, fig. 10; Heinemann (1967) Pl. 52; Imazeki and

Hongo (1987) Pl. 36, fig. 247; Imazeki *et al.* (1989) p. 181; Ito (1959) p. 266; Kawamura (1954) fig. 451; Levin *et al.* (1985) p. 53; Lincoff and Mitchel (1977) Pl. 8, fig. 27. Louwrens (1964) p. 15; McKnight and McKnight (1987) Pl. 29; Miller (1972) fig. 18; Morgan (1883) Pl. 2; Morris (1987) Pl. 2 - poor!; Natarajan and Kaviyarasan (1991) p. 70; Orr and Orr (1979) Pl. 76-poor!; Pegler (1983) Pl. 22G; Pearce (1977); Pomerleau (1980) fig. 494; Rinaldi and Tyndalo (1972) p. 36, fig. 3; Smith (1975) Pl. 117 -underside only; (1985) fig. 142; Stephens and Kidd (1953) Pl. 7A; Van der Westhuizen (1983) p. 37; Watling (1991) p. 23; Young (1982) Pl. E1; (1989) p. 11; Zoberi (1972) Pl. 15-poor!

Black and White illustrations as follows: Aberdeen (1979) Pl. 15A; Arietti and Tomasi (1975) p. 203 - poor!; Charles (1931) fig. 9 - good!; Chesnut (1900) Pl. 5; Floch *et al.* (1966) Pl. 8; Groves (1979) fig. 139; Guzman (1977) Pl. 150, fig. 370; Hard (1908) Pl. 7, fig. 35; McIlvaine (1900), Pl. 14-excellent!; Peerally and Sutra (1972), fig. 1-3; Pegler (1977), fig. 65; (1983), fig. 82 A-D; Pearce in Storrs & Pearce (1982), Pl. 34; Reinking (1921) fig. 22; Rowlee (1924), Pl. 11, fig. 1; Smith (1963), p. 185; Kellinga (1990), p. 78; Wasser (1985), Pl. 13, fig. 1- after Pegler (1977) q.v.; Wasser and Zakordonets (1986) fig. 1; Zoberi (1972), fig. 28.

Edibility

Judged from the literature there is a general consensus of opinion that *Chlorophyllum molybdites* is poisonous, at least to the majority of those who eat it, although not deadly. Furthermore it would seem to be more toxic when consumed raw. However, some people appear to be able to eat it without ill effects. It has also been reported as toxic to small animals according to Charters (1957) who attributed these data to Chesnut (1900) following Ford (1923). However, I cannot find this information in Chesnut's paper.

Singer (1955) suggested the possibility that there was a smaller spored edible form, but Pegler and Rayner (1969) and Pegler (1977) were unable to confirm this after an investigation of all the material available at Kew. They went on to suggest that the toxicity might be dependant upon climatic and habitat factors alone but with little evidence to support this view.

It seems more probable that certain individuals show varying susceptibility to the toxin produced by the fungus. Evidence for this comes from an account by Graff (1927) of a party of four in the Philippine Islands

who shared the same meal at which they ate this fungus, after which one person suffered no ill effects, another experienced only slight indigestion, a third was quite ill, while the fourth feared he would not live through the night, but survived with the aid of a doctor.

Floche *et al.* (1966) investigated both clinically and chemically, poisonous gathering from French Guyana and found a toxic substance, possibly an alkaloid, which was water soluble and extremely labile with respect to time and temperature.

Eilers and Nelson (1974) have published an account of the characteristics and partial purification of the toxin of *Chlorophyllum molybdites*, which according to Lincoff and Mitchel (1977) is a thermolabile protein molecule. This toxin is inactivated when heated in water to 70°C (158°F) for 30 minutes. According to Lincoff & Mitchel (l.c.) "this finding suggests that those who have been poisoned by this mushroom may not have cooked it sufficiently." However, such an hypothesis does not explain why persons sharing the same meal show such marked individual differences in their reaction to this fungus. Peerally and Sutra (1972) considered that there was a strong presumption that toxicity was due to the presence in the cap of aromatic amines, and that those fruitbodies 'consommés frais' in the stage with white gills are toxic, whereas those older specimens with blue-green gills and containing oxydized aromatic amines were not. This they suggested might explain why the fungus is sometimes reported as non toxic to certain persons.

Symptoms, which commence from 20 minutes to three hours after ingestion, are those of a gastro-intestinal upset of varying severity involving thirst, nausea, vomiting and diarrhoea, sometimes followed by a state of stupor. Some patients experience cold sweats or cramps, others may show blood stained mucus in their watery stools. Charters (1960) reported two cases of poisoning from Nakuru, Kenya involving a Sikh woman and European man. The woman, in addition to experiencing the above symptoms, showed "inversion of T-wave in all the praecordial leads of her electrocardiogram". Both patients suffered from circulatory collapse, but both recovered. [Note a more detailed medical account of the case involving the Sikh woman was reported by Charters, 1957]. Suggested treatment is to ensure that the patient rests, is kept warm, and is given a purgative. Most patients recover within a day or two.

South African authors are unanimous in considering *C. molybdites* to be poisonous but not deadly (Stephens and Kidd, 1953; Bottomley and Talbot, 1954; Louwrens, 1964; Van der Westhuizen, 1983; Levin *et al.*, 1985).

In West Africa *Chlorophyllum molybdites* is regarded as poisonous although the various authors note that in some parts of the world there may be edible forms or races, or alternatively that certain individuals may be able to eat the species without ill effects (Heinemann, 1968; Singer, 1969; Zoberi, 1972). However, Singer (1969) notes an instance of material from the Brazzaville region of the Congo being eaten, presumably with no ill effects, by the collector. Also a collection from Sierra Leone, Deighton, M. 2733 (in K) was noted as edible.

In East Africa the species is likewise recorded as poisonous. From Zambia, Pearce (1977, 1981, 1982) and Pegler and Pearce (1980) report that it definitely causes a severe gastro-intestinal upset. In Malawi it is regarded as inedible by the indigenous population (Morris, 1987); From Kenya, Pegler (1977) cites one collection [Nairobi, coll. Greenway] which was "said to have caused serious but not fatal poisoning to a European", while Charters (1960) reports two non-fatal poisonings from Nkuru, one involving a Sikh woman, and the other a European man. Ash (1976) lists it as poisonous in Ethiopia. From Mauritius, Peerally and Sutra (1972) have provided a personal account of poisoning following the ingestion of a small quantity of the caps and stems of freshly picked young fruitbodies in which the gills were still white. These were excellent to taste but produced gastro-intestinal symptoms, as outlined above after an interval of about 3 hours.

In Asia, *Chlorophyllum molybdites* is also regarded as a toxic species. Avizohar-Hershenzon (1967) has given a detailed account of its occurrence and toxicity in Israel, where it is thought to be an introduction from elsewhere. It first occurred in the Acclimatization Garden of the Agricultural Research Station in Rehovot in 1942. Two years later it spread to a neighbouring citrus orchard and is now found in irrigated gardens and lawns of *Stenotaphrum secundatum*, and is widely distributed in the Coastal Plain.

At least 150 cases of poisoning had been attributed to this fungus in the 25 years prior to 1967, and two-thirds of these involved children. Again the symptoms were of the general gastro-intestinal type discussed

above and commenced from 20 minutes to 3 hours after ingestion. However, in some cases these symptoms were accompanied by cramps or a rise in temperature. A quick recovery usually followed the same day. The author noted that the incubation time was shorter and the intensity of the symptoms more severe when the mushroom was eaten raw. Heinemann (1968) and Binyamini (1975) also noted its poisonous qualities.

In India it is reported as poisonous, often with the reservation that there may be edible forms or races (Singh and Mehrotra, 1974; Ghosh *et al.*, 1976; Sathe and Deshpande, 1980; Natarajan and Manjula, 1988; Purkayatha and Chandra, 1985). Recently Natarajan and Kaviyarasan (1991) have given a detailed case history of a 13-year old boy from Palavakkan, a suburb of Madras City, who ate one quarter of a fresh fruitbody. Since this account includes details of successful treatment using current methodology it is quoted extensively: The boy developed nausea after 30 minutes, followed after one hour by continuous vomiting. In addition he experienced a griping stomach pain in the upper abdomen (the epigastric region), followed by profuse, yellow watery diarrhoea. Hospitalization was necessary and "intravenous fluid consisting of 5% dextrose in normal saline and 5% dextrose" was administered to effect rapid rehydration. "Any residual toxin in the stomach was removed through Ryles tube aspirations". "Injection of Metaclopramide (10 mg) was given intramuscularly to control vomiting" and "injection of Lasix (lcc) was given intramuscularly to remove any toxic substances from the blood. No oral fluid was allowed until recovery. Vomiting was controlled with this treatment and all other symptoms subsided within 12 h. He started on oral fluids next day and on antacid along with ranitidine to prevent further damage to the gastric mucosa". The patient was advised to follow a bland diet for a few days, and within two days had complete recovery.

From Thailand, Hoiland and Schumacher (1982) report a case of poisoning in which the owner of a house and his family experienced severe diarrhoea and stomach ache after eating it.

The situation in the Philippines is particularly interesting as Copeland (1905) described a new species *Lepiota chlorospora* Copel., in a paper on esculent fungi of the islands, with the implication that it too was edible. This fungus is now commonly considered to be a synonym of *Chlorophyllum molybdites*. Later Graff

(1913) reported collecting this same fungus in the Manila area where it was growing in fairy rings in great profusion. The determination as *L. chlorospora* was confirmed by Copeland himself. Graff also went on to observe that while it was originally reported as an edible species 'cases have come to note where it has acted as a violent emetic'. Reinking (1921) also noted that it was poisonous.

Graff (1927) referring back to his finding of *L. chlorospora* in August 1912 reported on the results on a party of four who ate this fungus. Desirous of having a mushroom meal, they requested him to gather them sufficient of this mushroom. This he did with some hesitancy and after warning them of the dangers. The mushrooms were of same size, but only about half-expanded, with the gills still white. The result of this meal was that one member of the party reported that they were delicious and that he experienced no ill effects. Another 'felt some slight inconvenience but nothing very serious' and would, under normal circumstances, 'have thought little of it, deeming it no more than a passing indisposition, probably a light attack of indigestion'. The third member of the party was 'rendered quite ill' while it was feared that the fourth would 'not live through the night...' but did so with the aid of a doctor, and although weak from his experience, was about again in a day or so. Graff also provided details of the symptoms produced following the consumption of this fungus. These are basically the same as those reported above.

In reporting *C. molybdites* from Far Eastern Russia, Wasser (1985) and Wasser and Zakordonets (1986) indicate that this fungus is poisonous.

From Australia, Aberdeen (1979) commented that it is 'definitely poisonous if eaten uncooked or partially cooked, but has been eaten by a number of people after cooking. The symptoms included vomiting and diarrhoea'. Young (1982) also noted that it is poisonous as did Shepherd and Totterdell (1988) who again listed the same gastro-intestinal symptoms adding that "patients recover in a day or two". Young (1989) quotes a publication by Southcott (1974) reporting four separate poisonings in the Darwin area [presumably by *C. molybdites*], but in each instance 'the quantity consumed was rather small and the material either eaten raw or apparently only briefly cooked. The symptoms were consistent, and included initial drowsiness followed by violent vomiting with intense stomach pain, severe diarrhoea

with the vomiting of blood and mucus and temporary mild urinary disturbance. In some cases there was also a dusky blue colour in the finger nails and mouth region, suggesting methaemoglobinaemia. All patients recovered within 48 h and suffered no after effects'.

Young (l.c.) also records a discussion with J. E. C. Aberdeen at which the latter revealed that he had experimented with *C. molybdites* and that the results suggested the presence of a thermolabile substance. These findings are in accord with those of workers in other geographical regions across the world.

Young (l.c.) gave details of two further instances of poisoning following ingestion of this fungus, the identity of which was confirmed by Young himself. The poisoning occurred at Nanago in southern Queensland and involved a mother and her 26 year old daughter. Each ate half a raw cap about 3 cm in diameter, and the onset of symptoms occurred 30 minutes to two hours later.

The daughter suffered more acutely than the mother and had to be hospitalized for just about 2 days; both suffered initial drowsiness. The daughter on admission to hospital exhibited marked blueness of lips and tongue, together with dehydration; she had a high white cell count [12.3, normal 4.8-10.8] and the presence of protein and hyaline casts in the urine. Treatment involved intravenous rehydration using every 3 h, alternatively 500 ml of either Hartmans solution or 4% dextrose 0.18% saline solution until urinary function was fully restored. The cyanosis had disappeared by the following day.

An interesting aspect of these poisonings is that the mother had been eating the fungus previously for at least three years and considered it excellent for food. She either dried it for future use or cooked it shortly after collection; the dried material was reconstituted with water before cooking.

Young considers that the above poisonings 'strongly support the hypothesis that *C. molybdites* is quite toxic when raw, but is edible when cooked'. However, he emphasized that the term 'cooked' means very well cooked. However, the poisonings could equally be explained by the view of Peeraly and Sutra (1972) that the fungus is only poisonous in the young stages when the gills are still white. The fact that the caps when eaten were only 3 cm diameter in the above incident, suggests they must have been very young indeed.

South America: here there is more conflicting data

as to the poisonous versus the edible qualities of *C. molybdites*. This appears to have originated when Jenman collected material of a large lepiotoid fungus from the coastal plains of British Guiana (now Guyana) in 1892 and 1896, and sent it back to Kew for study by both Cooke and Masee, noting that it was an edible species. This material formed the basis for two new taxa i.e. *Lepiota ochrospora* Cke. & Masee - said to be "highly fragrant like the best mushroom and equally edible" and *Chlorophyllum esculentum* Masee which was described as an "Edible mushroom". Both epithets are now usually taken to be synonyms of *C. molybdites*. However, was Jenman merely reporting on the edibility of his own material or was he also recording local opinion on the subject? If he was citing his own experience, was he one of those lucky persons who are able to eat this fungus with impunity or was he, perhaps, eating only mature specimens? Alternatively is there an edible form of this fungus in Guyana? This latter suggestion seems unlikely in view of the fact that there are reports of poisonings by this fungus in nearby French Guyana (Floch, 1965; Floch *et al.*, 1966) and Dennis (1970) in his Fungus Flora of Venezuela notes that 'typical *C. molybdites* is poisonous to most people'. Again, Spegazzini (1899) noted that his *Annularia camporum* from Argentina, also usually taken to represent a synonym of *C. molybdites*, was edible, although sometimes dry and tough, becoming flaccid but not putrescent. In contrast, Martinez (1948) reporting what he erroneously thought to be the first occurrence of this fungus in Argentina noted that it caused temporary, violent gastrointestinal symptoms, which were rarely fatal, and disappeared spontaneously after two or three days.

In Central America the data is again conflicting. From Costa Rica, Rowlee (1924) reports that 'The natives of Costa Rica told Dr. Stork that it was good to eat.....'. However, Kreisel (1970) listed it from Cuba as poisonous, and it is likewise regarded as poisonous in Mexico (Perez Silva, Herrera and Guzman, 1970; Guzman and Johnson, 1974; Guzman, 1977; Davabos and Guzman, 1979; Ayala and Guzman, 1984; Perez-Silva and Aguirre-Acosta, 1986).

The situation in North America is similar. In the United States, authors are mostly in agreement in considering *C. molybdites* to be poisonous, although many comment on the fact that some people can eat it without ill effects. Haines (1984) records that it contains a

toxin unrelated to amatoxins and some authorities indicate that this can be largely destroyed or removed by heating or cooking (Hesler, 1960; Smith and Weber, 1985) while others report the opposite. Indeed Chesnut (1900) reports that it is still poisonous after a variety of methods of preparation such as after "frying, boiling, parboiling, discarding the cooking water, and then baking; and by cooking in various ways, after having previously allowed the fungi to lie in salt water".

In general, those persons who experience gastrointestinal symptoms of poisoning after eating this fungus, and these may be very severe and require hospitalization, usually recover in a day or two and suffer no further impairment to their health. However, Chesnut (1900) records one fatality which occurred at Champaign, Illinois in 1900, involving a two year old girl who ate an unknown quantity of the raw mushroom. McKnight and McKnight also note without specifying that "Some deaths have definitely been caused by Green Gill".

Authors who refer to the fungus as poisonous include the following: Charles, 1931; Murrill, 1937, 1949; Bessey, 1939; Singer, 1946; Wolfe and Wolfe, 1947; Miller, 1972; Smith, 1975; Orr and Orr, 1979; Sundberg and Richardson, 1980; Haines, 1984; Smith and Weber, 1985; Ammirati *et al.*, 1985; McKnight and McKnight, 1987. Those who, in addition to noting its poisonous qualities, also comment on the fact that some persons are able to eat it without ill effects include Lloyd, 1898; Chesnut, 1900; Atkinson, 1901; Hard, 1908; Moffat, 1909; Murrill, 1910; 1911; 1914; Webster, 1915; Kauffman, 1918; Horne and Condit, 1941; Smith, 1949, 1963; Dennis, 1952; Smith, 1954; Stubbs, 1971; Sundberg, 1971; Lincoff and Mitchel, 1977; Arora, 1979; McKnight and McKnight, 1987; Huffman *et al.*, 1989.

In citing the above reports on edibility it is usually unclear as to whether the authors were drawing on personal knowledge or merely perpetuating previously published data from the literature. In this context it is worth noting that Peck, who described *Lepiota morgani* in 1879, only learned of its toxicity in 1892 (Haines, 1984). However, Lloyd (1898) wrote "I have eaten it without any bad result, and Berry Benson used to write me it was a regular article of diet with him. Prof. Peck advises me however, that some of his correspondents report indisposition from eating it". McIlvaine (1900) quoting from a correspondent Mr. H. I. Miller of Terre Haute, Indiana, 1898 wrote "Six fam-

ilies, here, have eaten heartily of them. The experience is that one or two members of each family are made sick, though in two families, who have several times eaten them, no one was made sick. I enjoy them immensely, and never feel any worse for eating them. I doubt if we have a finer flavoured fungus. The meat is simply delicious". McIlvaine (l.c.) also quotes from data supplied to him by Prof. W. S. Carter, University of Texas, Galverton "on the poisoning of three laboring men from eating this fungus. They were seriously sick, but recovered". Hard (1908) observed 'I have known several families to eat it, making about half of the children in each family sick. I regard it as a dangerous plant to eat'. Horne and Condit (1941) reported a case where four people ate it following which two women experienced severe symptoms, one gentleman experienced mild effects and another was unaffected. Arora (1989) noted 'that after eating it several times without effect, I was made ill by some which sat in the fridge for two days'.

In Canada, *C. molybdites* is likewise considered to be poisonous, see Gussow and Odell (1927); Dearness (1927); Groves (1926); Weresub (1971); Pomerleau (1980); Ammirati *et al.* (1985).

Discussion

In general there has been a tendency to recognize but a single variable species of *Chlorophyllum* Masee, although in recent years a few additional, often not very distinctive taxa have been described. Pegler (1977, 1983) takes a broad concept of *C. molybdites*, and his fairly extensive synonymy has been accepted in this paper. However, Heinemann (1967) recognized a number of taxa on the basis of variation in spore size, the prominence of the germ pore and the colour of the spore print, but Pegler (l.c.) found these characters to be too variable to justify recognition of more than a single taxon. Nevertheless, we do not exclude the possibility that *C. molybdites* will ultimately be shown to comprise a number of closely related taxa, even within the confines of Southern Africa.

Several varieties of *Chlorophyllum molybdites* have been published as follows:

1. ***Chlorophyllum molybdites* var. *luteolosporum*** Sing. Pap. Mich. Acad. Sci. 32: 139. 1946. 'A typo differt sporis in cumulo luteolis recedit'.

This variety was said to differ "in the 'deep colonial buff' (R) spore print and lamellae" and to have a context tending to become reddish as well as yellow on injury. It grew solitary at the type locality. It was collected from Gainesville, Alachua County, Florida, by R. Singer.

2. ***Chlorophyllum molybdites* var. *marginatum*** (Smith) comb. nov.

Lepiota molybdites var. *marginata* Smith., Mushrooms in their Natural Habitats 1. 1949. 'A typo differt lamellae fuscomarginatae'.

A survey of the literature would seem to indicate only Sundberg (1971) has reported refinding *C. molybdites* var. *marginatum*. He wrote "California material studied in the fresh condition appears to be *C. molybdites* var. *marginata* A. H. Smith, but the lamellae margins are white in the button stage rather than dark as indicated in the original description of the variety (Smith, 1949). However, the margins do darken to almost black as the carpophores mature". Nevertheless, Ammirati *et al.* (1985) note under *C. molybdites*, that the gills are white in the early stages and remain white or become brown to almost black. McKnight and McKnight (1987) stated that the gill edges are dark fringed. These two descriptions suggest the variety *marginatum*, at least in part.

Smith, after publishing the variety *marginata*, based on material from Michigan, did not seemingly refer to it subsequently. However, his wife H. V. Smith (1954) published an account under this varietal name, which was somewhat confused, since she noted that "All collections are from the southern part of the state" (i.e. Michigan) and then that "var. *marginata* is known only from the type collection". It seems probable that the description should be seen as an inclusive account of the species *C. molybdites* in Michigan, rather than as a restricted one applicable only to var. *marginatum*, especially since she observed that it was var. *molybdites* that was the commonly encountered variety.

3. ***Chlorophyllum molybdites* var. *congolensis*** (Beeli) Heinemann, Fl. Icon, Champ. Congo 16: 323. 1967.

Agaricus congolensis Beeli, Bull. Soc. Roy. Bot. Belg. 61: 92. 1928.

This varietal epithet, proposed by Heinemann (1967); is here regarded as a straightforward synonym of *C. molybdites* and is not considered further in this discussion.

From a perusal of the literature it is clear that there is considerable variation in colour of the pileal scales in *C. molybdites*, ranging from conspicuous and dark brown to inconspicuous in shades of pale cinnamon or pale pinkish tan. Considerable variation in this feature was noted in collections from the Eastern Transvaal, and detailed accounts follow of two such gatherings.

The first comprised sporophores which were considerably smaller and more delicate than the typical form, and had scales on the cap which were pallid and far less prominent:

Pileus 5-6 cm diam., convex-campanulate with slight umbo, the surface disrupting into very pale buff, indistinct, applanate scales on a dirty white, silky, radially fibrillose background; the scales becoming more and more dispersed toward the shaggy appendiculate margin. *Lamellae* to 1 cm deep, free, attached to a collarium around the apex of the stem, blue green. *Stipe* to 8 cm high, 0.5 cm wide at the apex, enlarging to 1.2 cm at the slightly bulbous base, dirty white with an apical, movable ring. *Annulus* white, edged brown below. *Flesh* in socket after removal of stem becoming orange-red. Microcharacters as in typical form. *Habitat*: Tompi Seleka College of Agriculture, Lebowa, J. Malan, 26 Feb. 1989.

A further variant was collected with brown-dotted gill edge, which would seem to be referable to *C. molybdites* var. *marginatum*, described from the United States:

Sporophores initially drum-stick-like, with small conical cap closely applied to the apex of the stem, but soon expanding to hemispherical then convex and finally applanate. *Pileus* to 8 cm diam., but larger when fully expanded, initially pale buffy-brown with the entire surface soon becoming minutely tessellated, but subsequently ruptured by coarse tangential cracks revealing the underlying white flesh. The surface finally breaking up into prominent, evenly distributed, buffy-brown, concentrically disposed, loosely attached applanate scales on a white background, with the central disc entire and darker brown. The scales eventually completely disappear from a marginal zone 3 cm

wide, leaving the bare surface with a floccose-fibrillose texture. *Lamellae* greenish, with a dark brown dotted edge. *Stipe* to 13 cm high, 1.0-1.3 cm wide, cylindrical, but enlarged below to a basal bulb 1.5-3.0 cm wide, dirty white, and floccose-fibrillose above the apical ring. *Annulus* membranous, movable, white above, but underneath with buff-brown scales toward the margin. *Flesh* white over gills, but brown in centre and cortex of stem. *Surface of central disc* formed of a thick trichodermial palisade layer of erect, closely crowded, thin-walled hyphal elements to 90 μ m or more in length and 6-12 μ m wide, with obtuse apices, some with inflated bases to 18 μ m wide, others uninflated. In the lower portion of the trichoderm many hyphal segments inflated to 15 μ . *Cheilocystidia* thin-walled, sphaero-pedunculate to ovate, 24-40 \times 14-20 μ m, with a dark brown sap. *Basidia* 25-35 \times 9-10 μ m, thin-walled, hyaline, clavate, with 4 sterigmata. *Spores* 9.0-11.0 \times 6.5-8.0 μ m, amygdaliform, with complex dextrinoid wall and a prominent truncate germ pore.

Habitat: in open grass, L. C. de Villiers Sportsfield, D. A. Reid & A. Eicker, 14 Feb. 1989.

Literature Cited

- Aberdeen, J. E. C. 1979. Introduction to the Mushrooms, Toadstools and Larger Fungi of Queensland. Handbook No. 1. Queensland Naturalists Club.
- Acosta, S. and G. Guzman. 1984. Los hongos conocidos en el estado de Zacatecas. Bol. Soc. Mex. Micol. 19: 125-158.
- Ammirati, J. F., J. A. Traquair, and P. A. Horgen. 1985. Poisonous Mushrooms of the Northern United States and Canada. University of Minnesota Press. Minneapolis.
- Arietti, N. and R. Tomasi. 1975. I Funghi Velenosi. Edagricole, Bologna.
- Arora, D. 1979. Mushrooms Demystified. A comprehensive guide to the fleshy fungi of the Central California Coast. Ten Speed Press, Berkeley.
- Ash, J. W. 1976. Some Ethiopian Macroscopic Fungi. Walia 7: 10-15.
- Atkinson, G. F. 1901. Mushrooms. Edible, Poisonous, etc. Andries & Church, Ithaca.
- Avizohar-Herschenzon, Z. A. 1967. *Chlorophyllum molybdites* (Meyer ex Fr.) Mass. in Israel. Isr. J. Bot. 16: 63-69.
- Ayala, N. and G. Guzman. 1984. Los hongos de la Peninsula de Baja California I. The known species. Bol. Soc. Mex. Micol. 19: 73-91.
- Baker, R. E. D. and W. T. Dale. 1951. Fungi of Trinidad and Tobago. Mycological Papers No. 33. Commonwealth Mycological Institute, Kew.

- Bartholomew, E. 1927. The Fungous Flora of Kansas. Agricultural Experiment Station, Kansas State Printing Plant, Topeka.
- Beeli, M. 1928. Contribution a l'Etude de la Flore Mycologique du Congo. VI. Fungi Goossensiani. Bull. Soc. Roy. Bot. Belg. **61**: 78-107.
- Berkeley, M. J. 1880. Fungi Brasilienses in provincia Rio de Janeiro a clar. Dr. A. Glaziou lecti. Vidensk. Meddel. Dansk Naturhist. Foren. Kjobenhavn 1879 og 1880, 31-34.
- Bessey, E. A. 1939. A case of poisoning by *Lepiota morgani*. Mycologia **31**: 109-110.
- Binyamini, N. 1975. Fleshy Fungi of Israel. Hakibbutz Hamenachad Publishing House Ltd., Israel.
- Bottomley, A. M. and P. H. B. Talbot. 1954. Common Edible and Poisonous Mushrooms in South Africa. Department of Agriculture, Union of South Africa, Bulletin No. 324. (Botany and Plant Pathology Series, No. 17).
- Bresadola, G. 1896. Fungi Brasilienses lecti a cl. Dr. Alfredo Moller. Hedwigia **35**: 276-301.
- Cansrikul, A. 1977. Mushrooms in Thailand. Thai Watana-phanich, Bangkok (In Thai language).
- Charles, V. K. 1931. Some common mushrooms and how to know them. United States Department of Agriculture Circular No. 143.
- Charters, A. D. 1957. Mushroom poisoning in Kenya. Trans. Roy. Soc. Trop. Med. Hyg. **51**: 265-270.
- Charters, A. D. 1960. Mushroom Poisoning. Cent. Afr. J. Med. **6**: 213-214.
- Chen, Z. -C. 1987. Distribution of Agaricales in Taiwan. Trans. Mycol. Soc. China **2**: 1-21.
- Chesnut, V. K. 1900. Poisonous properties of the Green-spored *Lepiota*. Asa Gray Bull. **8**: 87-93.
- Chio, R. E. I. Frutis, G. Guzman, and V. M. Bandala. 1989. Hongos del estado de México. II. Especies citadas en la bibliografía: Agaricales. Rev. Mex. Micol. **5**: 125-148.
- Cooke, M. C. 1893. Exotic Fungi. Grevillea **21**: 73-75.
- Copeland, E. B. 1905. Fungi esculentes Philippinenses. Ann. Mycol. **3**: 25-29.
- Davalos, L. G. and G. Guzman. 1979. Estudio ecologico comparativo entre los hongos (Macromicetos) de los Bosques tropicales y los de coníferas del sureste de Mexico. Bol. Soc. Mex. Micol. **13**: 89-125.
- Davalos, L. G., G. Nieves, and G. Guzman, 1983. Hongos del estado de Jalisco. II. Especimenes depositados en el Herbario ENCB. I. Bol. Soc. Mex. Micol. **18**: 165-181.
- Dearness, J. 1927. Fleshy Fungi. Mycologia **19**: 228-229.
- Dennis, R. W. G. 1952. *Lepiota* and allied genera in Trinidad, British West Indies. Kew Bull. **7**: 459-499.
- Dennis, R. W. G. 1970. Fungus Flora of Venezuela and adjacent countries. Kew Bulletin Additional Series III. Her Majesty's Stationery Office, London.
- Desai, M. C. 1947. Occurrence of *Lepiota morgani* Pk. in Poona. Poona Agric. Coll. Mag. **38**: 41-48.
- Doidge, E. M. 1950. The South African Fungi and Lichens to the end of 1945. Bothalia **5**: 1-1094.
- Duss, R. -P. 1903. Enumération méthodique des Champignons recueillis a la Guadeloupe et a la Martinique. Lons-le-Saunier, Lucien Declume.
- Eilers, F. I. and L. R. Nelson. 1974. Characterization and partial purification of the toxin of *Lepiota morgani*. Toxicon **12**: 557-563 (n. v.).
- Floch, H. A. 1965. Un champignon toxique en Guyane francaise: la Lepiote de Morgan. Archives de l'Institut Pasteur de la Guyane francaise et de l'Inini. Publication No. 487.
- Floch, H., C. Labarbe. and J. Roffi. 1966. Etude experimentale de la toxicité de la Lépiote de Morgan. Rev. Mycol. **31**: 317-322.
- Ford, N. W. and E. D. Clark. 1914. A consideration of the properties of poisonous fungi. Mycologia **6**: 167-191.
- Ford, W. W. 1923. In F. Peterson, W. S. Haines and R. W. Weber (eds.) Legal Medicine and Toxicology. 2nd Ed. Vol. 2. W. B. Saunders Coy, Philadelphia. (n. v.) p. 817.
- Fries, E. M. 1838. Epicrisis Systematis Mycologici. Typographia Academica, Upsaliae.
- Frutis, I. and G. Guzman. 1983. Contribucion al conocimiento de los hongos del estado de Hidalgo. Bol. Soc. Mex. Micol. **18**: 219-265.
- Ghosh, R. N., N. C. Pathak, and B. P. Singh. 1976. The genus *Chlorophyllum* in India. Indian Phytopathol. **29**: 50-53.
- Graff, P. W. 1913. Additions to the Basidiomycetous Flora of the Philippines. Philipp. J. Sci. **8**: 299-310.
- Graff, P. W. 1914. Philippine Basidiomycetes, II. Philipp. J. Sci. **9**: 235-236.
- Graff, P. W. 1927. The green-spored *Lepiota*. Mycologia **19**: 322-326.
- Grandi, R. A. P., G. Guzman, and V. L. Bononi. 1984. Adicoes as Agaricales (Basidiomycetes) do Parque Estadual das Fontes do Ipiranga, Sao Paulo, S. P. Brasil. Rickia **11**: 27-33.
- Groves, J. W. 1979. Edible and Poisonous Mushrooms of Canada. (2nd revision). Agriculture Canada, Publication 1112.
- Gussow, H. T. and W. S. Odell. 1927. Mushrooms and Toadstools. An account of the more common edible and poisonous fungi of Canada. F. A. Acland, Ottawa.
- Guzman, G. 1961. Notes sobre algunas especies de agaricáceos no citados de Mexico. Anales Esc. Nac. Ci. Biol. **10**: 23-38.
- Guzman, G. 1963. Macromicetos de las zonas áridas de Mexico. I. Análisis taxonómica, ecológico y fitogeográfico de la investigación bibliográfica. Anales Esc. Nac. Ci. Biol. **12**: 43-60.
- Guzman, G. 1979. Identificación de los Hongos. Editorial Limusa, Mexico.
- Guzman, G. and D. A. Garcia Saucedo. 1973. Macromicetos del estado de Jalisco. I. Consideraciones generales y distribucion de las especies conocidas. Bol. Soc. Mex. Micol. **7**: 129-143.
- Guzman, G. and P. D. Johnson. 1974. Registros y especies nuevas de los hongos de Palenque, Chiapas. Bol. Soc. Mex. Micol. **8**: 73.
- Haines, J. H. 1984. A tragic *Lepiota* poisoning. McIlvainea **6**: 21-23.
- Hanlin, R. T. 1966. The Basidiomycetes of Georgia. Georgia

- Experiment Station. Mimeo Series N. S. 257: 1-36.
- Hard, M. E. 1908. The Mushroom, Edible or otherwise. Haffner Publishing Company. New York.
- Heinemann, P. 1967. Flore Iconographique des Champignons du Congo. Fasc. 16. *Chlorophyllum*. Hayez, Bruxelles.
- Heinemann, P. 1968. Le genre *Chlorophyllum* Mass. (Leucocoprineae). Aperçu systématique et description des espèces congolaises. Bull. Jard. Bot. Natl. Belg. 38: 195-206.
- Hesler, R. L. 1960. Mushrooms of the Great Smokies. University of Tennessee Press. Knoxville.
- Hilton, R. N. 1982. A census of the larger fungi of Western Australia. J. Roy. Soc. West. Aust. 65: 1-15.
- Hoiland, K. and T. Schumacher. 1982. Agarics, clavarioid and some Heterobasidiomycetous Fungi from Northern Thailand. Norw. J. Bot. 2: 265-271.
- Holden, M. 1970. Notes on the Agaric Flora from Ghana. J. West Afr. Sci. Assoc. 15: 25-34.
- Hongo, T. 1986. On the Agaricaceae of Japan. Trans. Mycol. Soc. Japan 27: 99-107.
- Horne, W. T. and I. J. Condit. 1941. *Lepiota morgani* an unwholesome fungus. Mycologia 33: 666-667.
- Huffmann, D. M., L. H. Tiffany, and G. Knaphus. 1989. Mushrooms and other fungi of the Midcontinental United States. Iowa State University Press, Ames.
- Imazeki, R. and T. Hongo. 1987. Coloured Illustrations of Mushrooms of Japan. I. Hoikusha Publishing, Co. Ltd., Osaka.
- Imazeki, R., Y. Otani, and T. Hongo. 1989. Fungi of Japan. Yama-Kei.
- Ito, S. 1959. Flora of Japan. Basidiomycetes No. 5. Agaricales, Gasteromycetales. Yokendo Ltd. Tokyo.
- Kauffman, C. H. 1918. The Agaricaceae of Michigan. *Lepiota* Fr. Wynkoop Hallenbeck Crawford Co., Lansing.
- Kawamura, S. 1954. Icones of Japanese Fungi. No. 4. Kazamashobo, Tokyo.
- Kreisel, H. 1970. Mykologische Eindrücke von Kuba. Mykol. Mitteilungsbl. 14: 73-80.
- Lee, Y. W. and Y. Rhee. 1958. A list of the Korean Fungi. II. Forestry Experiment Station, Seoul.
- Levetin, E., N. Jones, and K. Owens. 1990. A preliminary checklist of the Agaricales of Tulsa County, Oklahoma. Mycotaxon 36: 337-342.
- Levin, H., M. Branch. S. Rappoport, and D. Mitchell. 1985. A field guide to the Mushrooms of South Africa. C. Struik, Cape Town.
- Lincoff, G. and M. D. Mitchel. 1977. Toxic and Hallucinogenic Mushroom Poisoning. Van Nostrand Reinhold Company, New York, Cincinnati, Atlanta, Dallas, San Francisco, London, Toronto, Melbourne.
- Lloyd, C. G. 1898. 4. The Large Lepiotas. 5. *Lepiota morgani*. Mycological Notes No. 1, 4. Mycological Writings Vol. 1. Cincinnati, Ohio.
- Lloyd, C. G. 1898. 21. Short Notes. Mycological Notes No. 2, 11. Mycological Writings Vol. 1. Cincinnati, Ohio.
- Louwrens, B. A. 1964. Some Mushrooms of the Transvaal in Fauna and Flora. An official publication of the Transvaal Provincial Administration. No. 15. Hayne & Gibson, Johannesburg.
- Manjula, B. 1980. Taxonomic Studies on South Indian Agaricales. Ph. D. thesis, University of Madras (n. v.), Madras, India.
- Manjula, B. 1983. A revised list of the Agaricolid and Boletoid Basidiomycetes from India and Nepal. Proc. Indian Acad. Sci. (Plant Sciences) 92: 81-213.
- Manzi, J. 1976. Hongos Comestibles y Venenosos. Guadalajara.
- McIlvaine. 1900. One thousand American Fungi. Bowen-Merrill Company, Indianapolis.
- McKnight, K. H. and V. B. McKnight. 1987. A Field Guide to the Mushrooms of North America. Houghton Mifflin Company, Boston.
- Martin, G. W. 1937. Notes on Iowa Fungi. VII. Iowa Acad. Sci. 44: 45-53.
- Martinez, A. 1948. *Lepiota morgani*, Hongo Venenoso nuevo para La Argentina. Bol. Soc. Argent. Bot. 2: 169-173.
- Meyer, G. F. W. 1818. Primitiae Florae Essequebënsis. Henrici Dieterich, Gottingae.
- Miller, O. K. 1972. Mushrooms of North America. E. P. Dutton & Co., New York.
- Moffat, W. S. 1909. The Higher Fungi of the Chicago Region. Natural History Survey Bulletin VII. Pt. 1. The Hymenomycetes. Chicago Academy of Sciences, Chicago.
- Morgan, A. P. 1883. The Mycologic Flora of the Miami Valley, Ohio. J. Cincinnati Soc. Nat. Hist. 6: 54-95.
- Morgan, A. P. 1907. North American species of *Lepiota*. J. Mycol. 13: 1-18.
- Morris, B. 1987. Common Mushrooms of Malawi. Fungiflora, Oslo.
- Murrill, W. A. 1910. Poisonous Mushrooms. Mycologia 2: 255-264.
- Murrill, A. 1911. Agaricaceae of Tropical North America. 2. Mycologia 3: 79-91.
- Murrill, W. A. 1914. (Agaricales) Agaricaceae North American. Flora 10: 1-76.
- Murrill, W. A. 1919. Bahama Fungi. Mycologia 11: 222-223.
- Murrill, W. A. 1937. Notes and Brief Articles. Mycologia 29: 650.
- Murrill, W. A. 1949. Florida Lepiotas. Lloydia 12: 56-61.
- Natarajan, K. and V. Kawiyaaran. 1991. *Chlorophyllum molybdites* poisoning in India. Mycologist 5: 70.
- Natarajan, K. and B. Manjula. 1981. South Indian Agaricales. 14. Indian J. Bot. 4: 50-59.
- Ohasi, T. 1977. Studies on the habitats of *Chlorophyllum molybdites* (Meyer ex Fr.) Mass. with special reference to the physical conditions of soil. Trans. Mycol. Soc. Japan 18: 227-233.
- Ohasi, T. 1978. Studies on the chemical conditions of the habitat of *Chlorophyllum molybdites*. Trans. Mycol. Soc. Japan 19: 457-460.
- Orr, R. T. and D. B. ORR. 1979. Mushrooms of Western North America. California Natural History Guide 42. University of California Press, Berkeley, Los Angeles, London.

- Overholts, L. O. and M. F. Overholts. 1916. Some Kentucky Fungi. *Mycologia* 8: 249-252.
- Parks H. E. 1916. Tahitian Fungi collected by W. A. Setchell and H. E. Parks. *Univ. Calif. Publ. Bot.* 12: 49-59.
- Patouillard, N. 1899. Champignons de la Guadeloupe. *Bull. Soc. Mycol. France* 15: 191-209.
- Patouillard, N. 1913. Quelques champignons du Tonkin. *Bull. Trimest. Soc. Mycol. France* 29: 206-288.
- Peck, C. H. 1879. New species of fungi. *Bot. Gaz.* 4: 137-139.
- Peerally, A. and G. Sutra. 1972. Les champignons supérieurs de l'Île Maurice. *Rev. Agric. Sucri. l'Île Maurice* 51: 118-123.
- Pegler, D. N. 1977. A preliminary Agaric Flora of East Africa. *Kew Bulletin. Additional Series* 6, HMSO, London.
- Pegler, D. N. 1983. Agaric Flora of the Lesser Antilles. *Kew Bulletin. Additional Series* 9, Her Majesty's Stationery Office, London.
- Pegler, D. N. 1986. Agaric Flora of Sri Lanka. *Kew Bulletin. Additional Series* 12, HMSO, London.
- Pegler, D. N. and G. D. Pearce. 1980. The edible mushrooms of Zambia. *Kew Bull.* 35: 475-491.
- Pegler, D. N. and R. W. Rayner. 1969. A contribution to the Agaric flora of Kenya. *Kew Bull.* 23: 347-412.
- Peregrine, W. T. H. and K. B. Ahmad. 1982. Brunei: a first annotated list of plant diseases and associated organisms. *Phytopathological Papers, CMI.* No. 27.
- Perez-Moreno, J. and L. Villarreal. 1988. Los hongos y Myxomycetes del estado de Chiapas, Mexico. *Estado actual de conocimiento y nuevos registros. Micología Neotropical Aplicada* 1: 97-133.
- Perez-Silva, E. and E. Aguirre-Acosta. 1986. Macromicetos de zonas urbanas de Mexico. *Rev. Mex. Micol.* 2: 187-195.
- Perez-Silva, E., T. Herrera, and G. Guzman. 1970. Introducción al estudio de los Macromicetos tóxicos de México. *Bol. Soc. Mex. Micol.* 4: 20-40.
- Petersen, R. H. (undated) Check List of fungi of the Great Smoky Mountain National Park. *Management Report No. 29.* U. S. Department of the Interior National Park Service, Southeast Region.
- Pearce, G. D. 1977. Fungi of Zambia. *Orbit* 5: 13.
- Pearce, G. D. 1981. An introduction to Zambia's Wild Mushrooms. *Forestry Department, Kitwe.*
- Pearce, G. D. 1982. Mushroom Poisoning. *In* A. E. G. Storrs and G. D. Pearce. *Don't Eat These. A guide to some local poisonous plants.* Zambia Forest Department, Ndola. pp. 33-48.
- Pomerleau, R. 1980. *Flore des Champignons au Québec. Les éditions la presse, Montreal.*
- Portugal, D., E. Montiel, L. Lopez, and V. M. Mora. 1985. Contribucion al conocimiento de los hongos que crecen en la region de El Texcal, Estado de Morelos. *Rev. Mex. Micol.* 1: 401-412.
- Purkayastha, R. P. and A. Chandra. 1985. *Indian Edible Mushrooms. Today and Tomorrow's Printers and Publishers, New Delhi.*
- Quimo, T. H. 1983. Some unreported Agaricales of Mt. Makiling (Philippines). *Nova Hedwigia* 38: 421-432.
- Reinking, O. A. 1921. *Philippine Edible Fungi.* Philipp. Forest. Bur. Bull. 22: 103-148.
- Rinaldi, A. and V. Tyndalo. 1972. *Mushrooms and other fungi.* Hamlyn, London, New York, Sydney and Toronto.
- Rowlee, S. 1924. A collection of Costa Rican Fungi. *Mycologia* 16: 115-121.
- Sathe, A. V. and S. Deshpande. 1980. Agaricales (Mushrooms) of Maharashtra State. *Maharashtra Association for the cultivation of Science. Monograph No. 1,* 9-42. Pune, India.
- Sathe, A. V. and S. R. Rahalkar. 1976. Agaricales from South West India. 2. *Indian J. Mushrooms* 2: 77-80.
- Shephard, C. J. and C. J. Totterdell. 1988. *Mushrooms and Toadstools of Australia.* Inkata Press, Melbourne, Sydney.
- Singer, R. 1946. New and interesting species of Basidiomycetes. II. *Pap. Mich. Acad. Sci. Arts Lett.* 32: 103-150.
- Singer, R. 1955. Type studies on Basidiomycetes. VIII. *Sydowia* 9: 367-431.
- Singer, R. 1969. *Mycoflora australis.* *Beih. Nova Hedwigia* 29: 1-405.
- Singer R. and A. P. L. Digilio. 1951. *Prodrómo de la Flora Agaricina Argentina.* *Lilloa* 25: 1-448.
- Singh J. and B. S. Mehrotra. 1974. A survey of the gilled mushroom in India. *Beih. Nova Hedwigia* 47: 511-529.
- Smith, A. H. 1949. *Mushrooms in their Natural Habitats I & II.* Sawyers Inc., Portland, Ore.
- Smith, A. H. 1963. *The mushroom hunter's Field Guide.* (Revised and enlarged). University of Michigan Press, Ann Arbor.
- Smith, A. H. 1975. *A Field Guide to Western Mushrooms.* University of Michigan Press, Ann Arbor.
- Smith, A. H. and N. S. Weber. 1985. *Field Guide to Southern Mushrooms.* Ann Arbor. University of Michigan Press.
- Smith, C. O. 1936. *Lepiota morgani* in Southern California. *Mycologia* 28: 86.
- Smith, H. V. 1954. A revision of the Michigan species of *Lepiota.* *Lloydia* 17: 307-328.
- Southcott, R. V. 1974. Note on some poisonings and other clinical effects following ingestion of Australian fungi. *South Australian Clinics* 6: 441-478 (n. v.).
- Spegazzini, C. 1899. *Fungi Argentini novi vel critici.* *Anales Mus. Nac. Buenos Aires* 6: 81-367.
- Spegazzini, C. 1926. Contribucion al conocimiento de la Flora Micologica de las Sierras de Córdoba. *Bol. Acad. Nac. Cienc. Cordoba* 26: 113-190.
- Stephens, E. L. and M. M. Kidd. 1953. Some South African poisonous and inedible Fungi. *Longmans, Green & Co., Cape Town.*
- Stubbs, A. H. 1971. *Wild Mushrooms of the Central Midwest.* University of Kansas Press, Lawrence, K. S.
- Sundberg, W. J. 1971. The genus *Chlorophyllum* (Lepiotaceae) in California. *Madrono* 21: 15-20.
- Sundberg, W. J. and J. A. Richardson. 1980. Mushrooms and other fungi of land between the Lakes. *Department of Botany, Southern Illinois, University at Carbondale, Ill.*

- Theodoro, N. G. 1937. An enumeration of Philippine Fungi. Technical Bulletin of the Department of Agriculture of the Philippine Islands No. 4.
- Thiers, H. and E. Thiers. 1976. A preliminary check-list of the mushrooms of California, 1976 Revision (Cyclostyled).
- Van der Westhuizen, G. C. A. 1983. Mushrooms and Toadstools. A guide to the common edible, inedible and poisonous South African species. Bulletin 396. Plant Protection Research Institute. Department of Agriculture.
- Vellinga, E. 1990. Bijzondere waarnemingen en Vondsten. *Coolia* 33: 78-79.
- Wasser, S. P. 1985. Agaric Mushrooms of the USSR [Transl.] Naukova Dumka, Kiev.
- Wasser, S. P. and O. A. Zakordonets. 1986. Uncommon in the USSR genus and species of a Macromycete found in the Soviet Far East. *Mykol. Phytopathol.* 20: 11-14.
- Watling, R. 1991. A striking addition to the British Mycoflora. *Mycologist* 5: 23.
- Webster, H. 1915. A rash mycophagist. *Rhodora* 17: 30-32.
- Welden, A. L. and G. Guzman. 1978. Lista preliminar de Los hongos, liquenes y Mixomicetos de las regiones de Uxpanapa, coatzaacoalcos, Los Tuxtlas, Papaloapan y Xalapa (Parte de los estados de Veracruz y Oaxaca). *Bol. Soc. Mex. Micol.* 12: 59-102.
- Weresub, L. K. 1971. Congo red for instant distinction between poisonous *Lepiota molybdites* and edible *L. brunnea*. *Canad. J. Bot.* 49: 2059-2060.
- Wolf, F. A. and F. T. Wolf. 1947. *The Fungi* 2. Chapman & Hall Ltd., London.
- Young, T. 1982. Common Australian Fungi. New South Wales University Press, Kensington.
- Young, T. 1989. Poisoning by *Chlorophyllum molybdites* in Australia. *Mycologist* 3: 11-12.
- Zarco, J. 1986. Estudio de la distribución ecológica de los hongos (principalmente Macromicetos) en el Valle de México, Basado en los especímenes depositados en el herbario ENCB. *Rev. Mex. Micol.* 2: 41-72.
- Zoberi, M. H. 1972. *Tropical Macrofungi*. Macmillan Press Ltd., London and Basingstoke.

Chlorophyllum molybdites 之廣泛探討

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本文除了對 *Chlorophyllum* 屬加以概述外，並針對 *C. molybdites* 加以詳細的描述，尤其是有關此菌在南非發生之情形。文中並論及 *C. molybdites* 在全球之分佈、致毒性、毒發癥狀及處理方法。