REVISION OF THE LYCOPERDACEAE OF THE NETHERLANDS

by

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Introduction.

For this study which was suggested to me and promoted by Dr R. A. Maas Geesteranus I had at my disposal the material of the "Rijksherbarium" at Leiden, the herbaria of the Universities at Amsterdam, Groningen and Utrecht, and those of the "Koninklijke Nederlandse Botanische Vereniging", and the "Natuurhistorisch Museum", Maastricht. I wish to express my thanks to the directors of these institutions for putting the material at my disposal, and above all to the staff of the "Rijksherbarium", who gave me a great deal of valuable help, especially Dr Joséphine Th. Koster, Dr Maas Geesteranus and Dr S. J. van Ooststroom. I am indebted to Dr H. C. D. de Wit for the solution of some intricate nomenclatural questions, to H. J. T. Tammèl for drawing the figures.

Thanks to the presence of the herbarium of Persoon in the "Rijksherbarium" at Leiden, I was able to arrive at a better interpretation of a number of species described by him. This was especially important for the reason, that Persoon's "Synopsis Fungorum" of 1801 is the "starting-point" of nomenclature in the Gasteromycetes.

I use the name of *Lycoperdaceae* in the sense of Fisher in Engler-Prantl, Nat. Pflanzenfam., 2nd ed., vol. 7a, 1933, p. 62, thus excluding *Geastrum* and allies.

All descriptions are based upon specimens found in the Netherlands, unless otherwise stated.

History of the study of the Lycoperdaceae in the Netherlands.

To my knowledge nothing of scientific importance about the Netherlands *Lycoperdaceae* was published previous to 1866. It is true that statements of the occurrence of species may be found in literature, but they can not be verified because of the absence of authentic material and clear descriptions. I mention the following papers: Boerhaave, Index Alter Plantarum, 1720, p. 15; van Royen, Flor. Leyd. Prodr., 1740, p. 519; de Gorter, Fl. Gelro-Zutph., 1745, p. 203; Meese, Flor. Frisica, 1760, p. 85; de Gorter, Flor. Zutph., 1781, p. 86; Schuurmans Stekhoven, Kruidk. Handboek, 1818, p. 178; Dozy en Molkenboer, Tijdschr. Nat. Gesch. Physiol., vol. 11, 1844, p. 397; Gevers Deynoot et Abeleven, Flor. Noviomag., 1848, p. 154; van der Trappen, Bijdr. Neerl. Flora, 1852, p. 18.

In 1866 a revision of *Fungi*, including the *Lycoperdaceae*, in the Prodromus Flor. Bat., 1st ed., vol. 2, pars 4, 1866, p. 12—15 was published by Westendorp. Thanks to the presence of much of the cited material in the Herbaria at Leiden, it was possible to decide what species were meant (only of no. 2878, *L. turbinatum* a. *lividum* Pers., no specimens were found).

The same may be said of the papers by Oudemans (Ned. Kruidk. Archief, ser. 2, vol. 1, 1874, p. 166; Arch. Néerl., vol. 8, 1873, p. 253; id., vol. 15, 1880, p. 369—373; Révision Champ., 1892, p. 462—471; Cat. rais., 1904, p. 38—40). He was the first to give a key with good descriptions (in his Rév. Champ.). Because of the absence of material I could not find out what he meant by *Lycoperdon foetidum* Bon. (Ned. Kruidk. Arch., ser. 3, vol. 2, 1903, p. 199; Cat. rais., 1904, p. 38). He described a new species, *Lycoperdon favosum* Oud., based on one specimen, which could not be found. (See p. 491.)

All interpretations I give of the species mentioned by Westendorp and Oudemans are based on the authentic specimens cited by them, unless otherwise stated.

After Oudemans practically no progress was made in the study of the Netherlands *Lycoperdaceae*. Strangely enough, the more modern foreign literature was never taken into account. I mention: Destrée, Handleiding Hogere Zwammen, 1901, p. 298—303; Cool en v. d. Lek, Paddestoelenboekje, 1st ed., 1913, p. 285, 317; 2nd ed., vol. 2, 1920, p. 233, 241; 3rd ed., vol. 2, 1935, p. 236; 4th ed., vol. 2, 1943, p. 252.

In 1938 a species, new for the Netherlands, *Disciseda bovista* (Klotzsch) Kambly was found. Van Eyndhoven (Meded. Nederl. Mycol. Vereeniging, vol. 27, 1942, p. 3) has given an excellent, critical and up to date review of that species.

The latest complete list of the Netherlands species is that by Oudemans (Cat. rais., 1904, p. 38—40). It mentions 16 species of *Lycoperdon* and 2 of *Bovista*. They appeared to be 3 *Calvatias*, 6 *Lycoperdons* and 2 *Bovistas*.

During my investigation I found for the Netherlands 2 new *Lycoperdons*: *Lycoperdon umbrinum* Pers. and *Lycoperdon pyriforme* Pers. (this is not the species called by Oudemans *Lycoperdon piriforme* Rüpp.); 2 new *Bovistas*: *Bovista hungarica* Holl., *Bovista macrospora* Perdeck; and 1 *Bovistella*: *Bovistella radicata* (Dur. et Mont.) Pat. Together with *Disciseda*, there have now been found in the Netherlands 17 species of *Lycoperdaceae*, including 1 *Disciseda*, 3 *Calvatias*, 8 *Lycoperdons*, 1 *Bovistella*, 4 *Bovistas*. I have inserted some additional species, which may be expected to occur in the Netherlands.

General morphology; terminology (*fig. 1*).

The general form of the *Lycoperdaceae* varies from globose to elongate with a more or less distinct stem and a more or less globose head. In most species this form is very variable. The diameter of adult specimens varies from less than 1 cm to 65 cm.

The outer layer of the fungus is called p e r i d i u m. The outer part of the peridium, the e x o p e r i d i u m, consists of a more or less fugitive and loose structure of spines, warts, scales, fibrils or granules.

Sometimes it is more membranaceous (*Bovista*). The inner part of the peridium, the endoperidium, is more persistent and mostly smooth. It becomes visible in older specimens, when the exoperidium has fallen

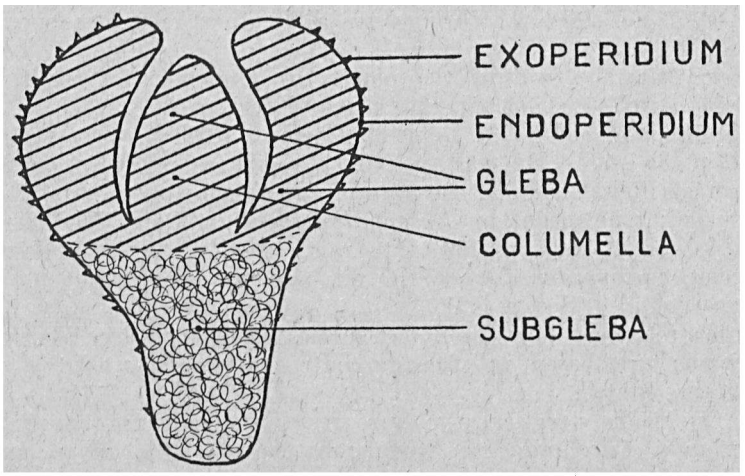

Fig. 1 — *Lycoperdon*, longitudinal section, scheme.

off. At maturity the peridium opens with a more or less definite, mostly apical, sometimes basal (*Disciseda*) pore, or the whole upper part of the peridium disappears (*Calvatia*). Transitions between these two extremes may be found (*Lycoperdon depressum*).

The peridium encloses the fertile portion, the gleba, and often a sterile portion below it, the subgleba. At maturity the gleba consists of a mass of spores and threads, the capillitium, and often shows in the centre of it a more or less definite part, the columella, which stands nearly free from the rest of the gleba, being attached to the subgleba. The subgleba may consist of small chambers, so-called cells, or of a compact, fibrillous mass. In the first case we speak of a cellular subgleba, in the second of a compact subgleba. The separation between gleba and subgleba may be more or less sharp. If the separation is sharp, we have to distinguish two cases. In the first case there is a distinct membrane between gleba and subgleba, the so-called diaphragm (*Lycoperdon depressum*). The cells of the subgleba lying under this diaphragm are then, in general, not smaller or more depressed than the more basal cells. In the other case there is no diaphragm, but the separation is due to the upper layer of cells, which become gradually more depressed towards the gleba, and are therefore not of the same size as the more basal ones (*Calvatia bovista*). It is not justified to speak of a well-defined diaphragm in this case as is done by Cunningham (see under *Calvatia bovista*).

The spores are mostly globose or subglobose, rarely ovoid or ellipsoid. They may be smooth or more or less warted. I call them strongly warted, if the warts are visible at the contour of the spore at a

magnification of 450 × as a series of fine knots, smooth if no warts are visible at a magnification of 1000 ×, and finely warted when they show a constitution between these two extremes. I examined the spores in diluted alcohol. Always spores of ripe specimens (when these are "dusty") should be examined, since the warts in unripe spores are not yet fully developed. Sometimes the spores bear a remaining pedicel.

The threads of the capillitium show the main characters for distinguishing the genera. There are two main types of threads. First the threads of the Bovista-type, which are small units, each consisting of a short, thick main stem with a number of slender ramose branches soon tapering to a point (*Bovista, Bovistella*). The second type, the Lycoperdon-type, consists of threads without a distinct thick main stem (*Calvatia, Disciseda, Lycoperdon*); if there are main stems, they are very slender and merge into the side branches very gradually. These threads are sometimes much, sometimes little branched. They may break up into small pieces when maturing (*Disciseda, Calvatia bovista*). Sometimes they are hyaline and septate, but mostly coloured and not septate. About the structure of the capillitium see further: Hesse, Pringsheim's Jahrb., vol. 10, 1876, p. 383—398 and Tulasne, Ann. Sc. Nat., 2e ser., vol. 17, 1842, p. 5—18; the last-named author also gives very interesting particulars about the differences in the form of the basidia, etc. of several *Lycoperdon*-species.

Abbreviations:

L or HLB = Herbarium Lugduno-Batavorum, the "Rijksherbarium" at Leiden.
NBV = Herbarium of the "Koninklijke Nederlandse Botanische Vereniging" at Leiden.
A = Herbarium of the University of Amsterdam.
U = Herbarium of the University of Utrecht.
GRO = Herbarium of the University of Groningen.
Maastr. = Herbarium of the "Natuurhistorisch Museum" at Maastricht.
Coll. Hoogland = Herbarium of Mr. R. Hoogland.

Gr. = Province Groningen.		N.H. = Province Noord-Holland.	
Fr. = „	Friesland.	Z.H. = „	Zuid-Holland.
Dr. = „	Drente.	Zeel. = „	Zeeland.
Ov. = „	Overijsel.	N.B. = „	Noord-Brabant.
Gld. = „	Gelderland.	Limb. = „	Limburg.
Utr. = „	Utrecht.		

* means: not yet found in the Netherlands.

Key to the genera of Lycoperdaceae.

1a. Capillitium of short, slightly branched threads, furnished with short spines; peridium thick, mostly stellately opening with lobes; subgleba wanting . . . . . **6*. Mycenastrum**

1b. Threads of capillitium without spines.

2a. Capillitium of little units, each consisting of a thick, short main stem and slender ramose branches with ends tapering to a point; spores (of the Netherlands species) with long persistent pedicels.

3a. Subgleba wanting; fungus soon loosening from the substratum; main stem of capillitium more than 10 μ thick . . . . . **5. Bovista**

3b. Subgleba present; fungus permanently attached to the substratum; main stem of capillitium less than 10 μ thick . . . . . **4. Bovistella**

2b. Threads of capillitium without a thick conspicuous main stem; spores (of the Netherlands species) without pedicels.
4a. Peridium, or at least the upper part of it, dehiscent as a whole; diaphragm and columella wanting . . . . . 2. **Calvatia**
4b. Peridium dehiscent by a more or less regular pore; sometimes this pore is very large, and in this case a diaphragm is present.
5a. Fungus soon loosening from the substratum; with a cup-shaped crust of soil adhering to remaining part of the exoperidium; capillitium threads soon breaking up into short pieces; subgleba wanting 1. **Disciseda**
5b. Fungus permanently attached to the substratum, without a cup-shaped crust of soil; capillitium not broken up into short pieces; subgleba mostly present . . . . . 3. **Lycoperdon**

Key to the Netherlands species of Lycoperdaceae, neglecting the microscopical characters.

1a. Subgleba wanting, or, if present, compact, of the same structure as the gleba.
2a. Fungus 7—65 cm in diam., globose . . . . . **Calvatia gigantea**
2b. Smaller.
3a. With a more or less cup-shaped crust of adherent soil; fungus soon loosening from the substratum . . . . . **Disciseda bovista**
3b. Without such a crust.
4a. Fungus rooting, attached to the substratum; exoperidium consisting of furfuraceous spines or scales; subgleba sometimes present; gleba coherent . . . . . **Lycoperdon ericetorum**
4b. Fungus not rooting, soon loosening from the substratum; exoperidium membranaceous, nearly smooth, flaking off at maturity; subgleba always wanting; gleba incoherent, flocculose.
5a. Endoperidium at maturity brown-purplish, maculate; gleba at maturity purplish . . . . . **Bovista nigrescens**
Bovista hungarica
5b. Endoperidium at maturity lead-coloured, or brownish, not maculate; gleba never purplish . . . . **Bovista plumbea**
cf. also **Bovista macrospora**
1b. Subgleba present, cellular.
6a. Diaphragm present . . . . . **Lycoperdon depressum**
6b. Diaphragm wanting.
7a. At least the whole upper part of the peridium disappears at maturity.
8a. Stem mostly distinct; exoperidium consisting of fugacious small spines, scales or granules . . . . . **Calvatia excipuliformis**
8b. Stem rarely distinct; exoperidium consisting of a more or less dense, floccose, subpersistent coat, at last breaking up in scales.
9a. 5—10 cm high . . . . . **Calvatia bovista**
9b. 2—3½ cm high . . . . . **Bovistella radicata**
7b. Peridium at maturity opening with a more or less definite apical pore.
10a. Without distinct spines.
11a. Columella very distinct; mostly caespitose, on wood.
Lycoperdon piriforme
11b. Columella not very distinct; not caespitose, on wood.
12a. Gleba coherent, often with an indistinct columella; exoperidium consisting of more or less fugacious small scales or granules.
13a. Gleba, when fully mature, purplish; its structure not clearly separated from that of the subgleba; mostly in woods . . . . . **Lycoperdon molle**
13b. Gleba never purplish; its structure more or less clearly separated from that of the subgleba; mostly in open places . . . . **Lycoperdon spadiceum**
12b. Gleba incoherent, flocculose, without columella; exoperidium consisting of a more or less dense floccose subpersistent coat . . . . . **Bovistella radicata**

10b. With distinct spines.
14a. Spines not in small groups, exoperidium with a distinct reticulate structure . . **Lycoperdon perlatum var. typicum**
14b. Spines in small groups, or, if not so, exoperidium without a distinct reticulate structure.
15a. Spines in small groups.
16a. Spines dark-brown **Lycoperdon perlatum var. nigrescens**
16b. Spines of a brighter colour.
17a. Spines stout, groups of spines falling off in patches; gleba never purplish **Lycoperdon candidum**
17b. Spines slender, not falling off in patches; gleba purplish, when wholly mature **Lycoperdon molle**
15b. Spines not in groups.
18a. Spines stout, coarse **Lycoperdon perlatum var. bonordeni**
18b. Spines slender, fine, dark . **Lycoperdon umbrinum**

1. DISCISEDA Czern.

in Bull. Soc. Imp. Moscou vol. 18, 1845, p. 153 — *Catastoma* Morg. in J. Cincinn. Soc. Nat. Hist. vol. 14, 1892, p. 142.

Fungus growing just below the surface of the soil or partially exposed, subglobose; exoperdium impregnated with soil and at maturity breaking away circumscissilely, leaving the lower part in the soil, the apical part remaining as a kind of cupula; endoperidium opening by a basal pore; capillitium threads long, branched, breaking up into short pieces when mature.

Key to the species.

1a. Spores 4—5 μ in diameter, minutely warted . . . . . **1*. D. candida**
1b. Spores 6—9 μ in diameter, strongly warted . . . . . **2. D. bovista**

1*. **Disciseda candida** (Schw.) Lloyd, Myc. Notes, vol. 1, 1902, p. 100; Cunningham in Proc. Linn. Soc. N. S. Wales, vol. 52, 1927, p. 238; Gaster. Austr., 1942, p. 137; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1934, p. 46; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 152; Bottomley in Bothalia, vol. 4, 1948, p. 570 — *Bovista candida* Schw., Syn. Fung. Carol., 1822, no. 333 — *Disciseda circumscissa* (Berk. et Curt.) Hollós in Termész. Füz., vol. 25, 1902, p. 102, 132; Gastr. Ung., 1904, p. 119; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 35.

Distribution: Europe (Sweden, Hungary, Czechoslovakia, Rumania), South Africa, America, Australia, Asia. Not yet found in the Netherlands.

2. **Disciseda bovista** (Klotzsch) Kambly in Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 153; van Eyndhoven in Meded. Ned. Myc. Ver., vol. 27, 1942, p. 3, 10 — *Geaster Bovista* Klotzsch in Nov. Act. Leop., vol. 19, suppl. 1, 1843, p. 243 — *Disciseda compacta* Czern. in Bull. Soc. Imp. Nat. Moscou, vol. 18, 1845, p. 153; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 35 — *Catastoma subterraneum* (Peck) Morg. in J. Cincinn. Soc. Nat. Hist., vol. 14, 1892, p. 143; Lloyd, Myc. Notes, vol. 1, 1903, p. 122; vol. 7, 1922, p. 1168 — *Disciseda debre-*

ceniensis (Hazsl.) Hollós in Termész. Füz., vol. 25, 1902, p. 102, 132; Gastr. Ung., 1904, p. 119.

Description principally after Van Eyndhoven.

Fungus 10—35 mm in diam., globose or subglobose, developing hypogaean, emerging at maturity and turning upside down; exoperidium, at least at maturity, consisting of 2 parts, the lower part being a thin membrane of grey to light brown colour, practically without debris, only with fine grains of sand sticking to it, at maturity loosening and remaining in the ground; the apical part consists of a similar membrane, but is covered with adherent soil, forming a persistent cup-shaped disk on the top of the fungus, visible as a small dark spot in the surface of the soil before emerging; endoperidium tough, solid, rather thick and hard, coriaceous to papyraceous, smooth, pale, whitish, grey, light brown or in older specimens plumbeous; pore not apical but basal, somewhat irregular, 4—10 mm in diam., flattened to mammose, often not well developed and not open; often there may be seen one or two additional irregular perforations; gleba umber-brown, powdery; spores 6—8 μ in diam.; globose, strongly verrucose; capillitium threads 3—4 μ thick, ramose, broken into pieces of varying length.

Habitat: on mossy places in the dunes, solitary or in small groups, October.

Specimens examined: Z.H.: Wassenaar (Meyendel) 1938, 1939, *Boetje-van Ruyven* (L); 1939, *Van Eyndhoven* (L); *de Lint* (L); (Raaphorst), 1949, *Perdeck* (L); (Voorlinden), 1948, *Maas Geesteranus* 4344 (L).

Distribution: Europe (Sweden, Netherlands, Germany, Hungary, Caucasus), S. Africa, Australia, America, Asia.

Remarks:

1. The first to use the combination *Disciseda bovista* was Kambly (l. c., 1936). Erroneously, van Eyndhoven attributed this combination to Hollós (l. c., 1942).

2. Cunningham (Proc. Linn. Soc. N. S. W., vol. 52, 1927, p. 238 and Gaster. Austr., 1942, p. 138) and Bottomley (Bothalia, vol. 4, 1948, p. 570) called the species *D. cervina* (Berk.) Holl. in Hedwigia vol. 42, 1903, p. (22). Van Eyndhoven l. c. showed that this was not correct.

2. CALVATIA Fr.

Summa Veg. Scand., vol. 2, 1849, p. 442; emend. Morgan in J. Cincinn. Soc. Nat. Hist., vol. 12, 1890, p. 165 — *Langermannia* Rostk. in Sturm, Deutschl. Fl. Abth. 3, fasc. 18, 1839, p. 3, 23.

Differs from *Lycoperdon* by the irregular dehiscense of at least the whole upper part of the peridium; columella and diaphragm wanting; in general large species.

Remarks:

1. The oldest valid name is *Langermannia* Rostk. 1839. Since this name has never been in general use, I propose to consider **Calvatia** a **nomen conservandum.**

2. The separation of this genus from *Lycoperdon* is not very satisfactory. *L. depressum* e. g. could be placed under either genus. Moreover

the difference between *Calvatia excipuliformis* and *Lycoperdon molle* is not very clear (see under these species).

Key to the species of Calvatia.

1a. Subgleba wanting, or, if present, compact, not cellular of the same structure as the gleba; threads of capillitium septate.
  2a. Spores, when mature, smooth or minutely warted, warts not visible at an enlargement of 450 × . . . . . **1. C. gigantea**
  2b. Spores, when mature, strongly warted, warts visible at an enlargement of 450 ×.
    3a. Gleba soon turning purple . . . . . **2*. C. cyathiformis**
    3b. Gleba never purple . . . . . **3*. C. candida**
1b. Subgleba present, cellular; threads of capillitium not septate.
  4a. Spores, when mature, smooth or minutely warted, warts not visible at an enlargement of 450 ×; threads of capillitium mostly thicker than the spores, soon broken up into short pieces . . . . . **4. C. bovista**
  4b. Spores, when mature, strongly warted, warts visible at an enlargement of 450 ×; threads of capillitium mostly thinner than the spores, not broken up into short pieces . . . . . **5. C. excipuliformis**

1. Calvatia gigantea (Pers.) Lloyd, Myc. Notes, vol. 1, 1904, p. 166; ibidem, vol. 1, Lyc. Austr., 1905, p. 36; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 21; Cunningham in Proc. Linn. Soc. N. S. W., vol. 51, 1926, p. 366; Bottomley in Bothalia, vol. 4, 1948, p. 573; Kambly and Lee in Univ. of Iowa Stud. vol. 17, 1936, p. 135 — *Lycoperdon giganteum* Pers., Syn. Fung., 1801, p. 140; in J. de Bot., vol. 2, 1809, p. 16; Peck in N. York State Mus. Nat. Hist., Rep. 32, 1879, p. 62; Oudemans in Arch. Néerl., vol. 15, 1880, p. 371 — *Bovista gigantea* (Pers.) Nees, Pilze, 1817, p. 34; Cool en v. d. Lek, Paddestoelenboek vol. 2, 1920, p. 233, 1935, p. 239, 1943, p. 255 — *Lycoperdon Bovista* Bull. ex Pers., Syn. Fung., 1801, p. 141, pro syn.; Vittadini, Mon. Lyc., 1842, p. 37; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 181; Westendorp in Prodr. Fl. Bat., vol. 2, pars 4, 1866, p. 14; Oudemans, Rév. Champ., 1892, p. 468; Cat. rais., 1904, p. 38 (non Pers., Syn. Fung. 1801, p. 141) — *Lycoperdon maximum* Schaeff. ex Pers., Syn. Fung., 1801, p. 140, pro syn. — *Calvatia maxima* (Schaeff. ex Pers.) Morg. in J. Cincinn. Soc. Nat. Hist., vol. 12, 1890, p. 166; Hollós, Gastr. Ung., 1904, p. 81; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1934, p. 30.

Fungus 7—25 cm in diam., sometimes 65 cm (van Herweynen, Fungus, vol. 6, 1934, p. 29), subglobose; peridium white or yellowish, thick (to 3 mm), nearly smooth (exoperidium nearly absent), flaking off in irregular patches over the whole surface, when mature; gleba umber-brown when ripe, forming a more or less compact mass, which remains after the peridium has fallen off; subgleba scanty, compact, fibrillose, difficult to be distinguished from the gleba; spores 3,8—4,9 μ in diam., globose or subglobose, smooth or very finely warted; threads of capillitium up to 6,3 μ in diam., faintly coloured, septate, not very strongly ramose.

Habitat: grass-fields and manured grounds, gardens; mostly in groups, sometimes in large circles; from Aug. to Dec.

Specimens examined (from places with a literature reference, I have seen no material) Gld.: Bommelerwaard, 1899, *Flentge* (Lev. Natuur, vol. 4, 1899, p. 207); Malden, 1939, *Jansen* (L); Middachten, 1934, *Exc. N. N. V.* (Fungus, vol. 6, 1934, p. 38);

Nijmegen (*Oudemans*, l. c. 1892, p. 468); N. H.: Alkmaar, 1934, *Schweers* (Fungus, vol. 6, 1934, p. 52); Amsterdam, 1852, *van der Sande Lacoste* (L); 1918, *van Vlerken* (A); Haarlem?, *Greshoff* (L); Haarlem, 1914, *Cool* (L); Schagen, 1930, 1934, *van Herweynen* (Fungus, vol. 6, 1934, p. 29); Z. H.: 's-Gravenhage, 1948, *van Kregten* (L); Koudekerk, 1948, *Laman* (L); Koudekerk, 1948, *Fierêt* (L); Leiden, 1911, *van der Lek* (L); Oude Wetering, 1948, *Smits* (L); Vennemeer, 1943, *Maas Geesteranus* (L); Westland (*Oudemans*, l. c., 1892, p. 468); N. B.: 's Hertogenbosch (*Oudemans*, l. c. 1892, p. 468); Limb.: Gennep, 1948, *Schweers* (L); Maastricht, 1943, *Exc. Nat. Hist. Gen.* (Nat. Hist. Maandbl., vol. 33, 1943, p. 90).

Distribution: Europe (Sweden, Denmark, England, Netherlands, Belgium, Germany, Austria, France, Switzerland, Czechoslovakia, Rumania, Hungary, Jugoslavia, Bulgary, Italy), S. Africa, N. America, Asia.

Remarks:

1. Persoon left no material of the present species, but there can be no misunderstanding about what he meant.

2. The first to use the combination *Calvatia gigantea* was Lloyd (1904). This combination was found independently by T. C. E. Fries (1921) and by Cunningham (1926).

2*. **Calvatia cyathiformis** (Bosc) Morg. in J. Cincinn. Soc. Nat. Hist., vol. 12, 1890, p. 168; Hollós, Gastr. Ung., 1904, p. 84; Kambly and Lee in Univ. of Iowa Stud. vol. 17, 1936, p. 137 — *Lycoperdon cyathiforme* Bosc in Ges. Nat. Freunde Berlin Mag., vol. 5, 1811, p. 87 — *Lycoperdon fragile* Vitt., Mon. Lyc., 1842, p. 36; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 180; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 55 — *Bovista lilacina* Mont. et Berk. in Hooker, Lond. J. of Bot., vol. 4, 1845, p. 64 — *Calvatia fragilis* (Vitt.) Morg., in J. Cincinn. Soc. Nat. Hist., vol. 12, 1890, p. 168 — *Calvatia lilacina* (Mont. et Berk.) Lloyd, Myc. Notes, vol. 1, Lyc. Austr., 1905, p. 35; Cunningham, in J. Linn. Proc. Soc. N. S. Wales, vol. 51, 1926, p. 365; Gaster. Austr., 1942, p. 157; Stevenson and Cash, Bull. Lloyd Libr., vol. 35, 1936, p. 172; Bottomley in Bothalia, vol. 4, 1948, p. 572.

Distribution: Europe (Germany, Austria, Russia, Hungary, France, Portugal, Italy, Greece), Africa, America, Asia. Not yet found in the Netherlands.

3*. **Calvatia candida** (Rostk.) Holl. in Termész. Füz., vol. 25, 1902, p. 112, 137; Gastr. Ung., 1904, p. 89; Cunningham in J. Proc. Linn. Soc. N. S. Wales, vol. 51, 1926, p. 367; Gaster. Austr., 1942, p. 158; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1934, p. 34; Bottomley in Bothalia, vol. 4, 1948, p. 575 — *Langermannia candida* Rostk., in Sturm, Deutschl. Fl., vol. 3, fasc. 18, 1839, p. 25.

Distribution: Europe (France, Germany, Hungary, Italy), S. Africa, Australia. Not yet found in the Netherlands.

4. **Calvatia bovista** (Pers.) Th. Fr. Jr. in Ark. f. Bot., vol. 17, no. 9, 1921, p. 21; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 138 — *Lycoperdon Bovista* Pers., Syn. Fung., 1801, p. 141, in J. de Bot., vol. 2, 1809, p. 16 (non Bull. ex Pers., Syn. Fung., 1801, p. 141, pro syn.) — *Lycoperdon caelatum* Bull. ex Pers., Syn. Fung., 1801, p. 141, pro syn.; Vitt., Mon. Lyc., 1842, p. 44; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 188; Westendorp in Prodr. Fl. Bat., vol. 1, pars 4, 1866, p. 14, p.p.; Oudemans in Arch. Néerl., vol. 15, 1880, p. 370; Rév. Champ., 1892,

p. 468; Cat. rais., 1904, p. 38 — *Bovista officinarum* Rostk. in Sturm, Deutschl. Fl., vol. 3, fasc. 18, 1839, p. 5 — *Bovista suberosa* Rostk., l. c. p. 7 (non Fr.) — *Calvatia caelata* (Bull. ex Pers.) Morg., in J. Cincinn. Soc. Nat. Hist., vol. 12, 1890, p. 169; Hollós, Gastr. Ung., 1904, p. 83; Lloyd, Myc. Notes, vol. 1, 1904, p. 166, Lyc. Austr., 1905, p. 35; Cunningham in Proc. Linn. Soc. N. S. Wales, vol. 51, 1926, p. 365; Gaster. Austr., 1942, p. 156; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1934, p. 31; Bottomley in Bothalia, vol. 4, 1948, p. 572 — *Calvatia favosa* (Rostk.) Lloyd, Myc. Notes, vol. 1, Lyc. Austr., 1905, p. 36 — *Calvatia Fontanesii* (Dur. et Mont.) Lloyd, l. c. p. 36.

Fungus 4—10,5 cm high, 3,5—10,5 cm wide, mostly about as high as wide, mostly depressed at the upper side, narrowing gradually into the base; stem mostly not very distinct; exoperidium consisting of a fairly dense layer of white, grey or brown hairy fibres, which either form an even velvety layer, or stand in little groups. These groups give rise to either spinulose flocks, or to definite spinulose scales, which form a more or less areolated structure; these structures are pretty persistent and disappear only by old specimens; endoperidium light brown, glossy, dehiscing irregularly at the upper side, after which the gleba falls out and so only the subgleba, with a low, upright, mostly fairly regular lobed collar, remains; gleba when mature olive- or umber-brown, without columella, little coherent, easily loosening from the subgleba; subgleba occupying about ½ of the total height, sharply separated from the gleba, but without diaphragm, minutely cellular, yellowish to purplish-brown; root often strongly developed; spores 3,4—4,5 μ in diam., globose or subglobose, smooth; threads of capillitium up to 7,0 μ thick, mostly thicker than the spores, pale coloured, not septate, more or less branched, soon breaking up into small fragments, slack — *fig. 2.*

Habitat: grassfields, dunes, often in deciduous woods, July to Nov. (March, April, May).

Specimens examined: Gld.: Brummen, 1863, *Oudemans* (GRO); Epe, 1948, *Kleyn* (L); Nijmegen, *Abeleven* (L); Osseveld, 1894, *Kok Ankersmit* (L); Ruurlo, 1948, *Agsteribbe* (L); Wilp, 1947, 1948, *van Heurn* (L); N. H.: Amsterdamse Bos, 1948, *Schutte* (L); Ankeveen, 1916, *van Overeem* (A); Bergen, 1914, *van Overeem* (A); Castricum, 1914, *van Overeem* (A); Haarlem, 1918, *Ned. Myc. Ver.* (A); Heemstede, 1862, *Hartsen* (GRO); Vlieland, 1949, *van Heurn* (L); Z. H.: 's-Gravenhage, *Perdeck* 162 (L); Leiden, 1846, *Oudemans* (GRO); Oostvoorne (Kwakjeswater), 1915, *Goethart* (L); Oud Ade, 1948, *Maas Geesteranus* 4281 (L); Scheveningen, 1948, *Zaneveld* (L); Wassenaar (Meiendel), 1927, *Schure* (L); 1948, 1949, *Perdeck* 163, 200 (L); *Molkenboer* (L); Zeel.: Z. Beveland, *van den Bosch* (L); Zwake, 1844, *van den Bosch* (L); Limb.: Gennep, 1948, *Schweers* (L).

Distribution: Europe (Sweden, Denmark, England, Netherlands, France, Germany, Switzerland, Austria, Czechoslovakia, Hungary, Rumania, Russia, Italy), Africa, Australia, N. America, Asia.

Remarks:

1. According to Cunningham (l. c.) and Bottomley (l. c.) this species has a well defined diaphragm. Neither the specimens found in the Netherlands, nor the type in Persoon's herbarium show any trace of it. I suspect these authors did not notice the difference between a mere sharp separation between gleba and subgleba and the presence of a diaphragm (see p. 482).

2. In Persoon's herbarium three *Calvatia*-specimens may be found to which Persoon has added the name *Lycoperdon Bovista*. One of these (no. HLB 910. 258—454) is *Calvatia cyathiformis* (Bosc) Morg. The two others are the species in question. I consider no. HLB 910. 258—460 as the type specimen, for Persoon wrote under the name: "Syn. fung.", and so referred to his original description of this species.

3. T. C. E. Fries (l. c. 1921) was the first to make the combination *Calvatia bovista* and not Kambly and Lee (l. c. 1936), as they believed.

5. Calvatia excipuliformis (Pers.) Perdeck, nov. comb. — *Lycoperdon excipuliforme* Pers., Syn. Fung. 1801, p. 143; in J. de Bot., vol. 2, 1809, p. 21 (non Scop.) — *Lycoperdon macrorhizon* Pers. in J. de Bot., vol. 2, 1809, p. 22 — *Lycoperdon saccatum* Fr., Syst. Myc., vol. 3, 1829, p. 35; Westendorp in Prodr. Fl. Bat., vol. 2, pars 4, 1866, p. 13; Oudemans in Arch. Néerl., vol. 15, 1880, p. 371; Rév. Champ., 1892, p. 467; Cat. rais., 1904, p. 40; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 53 (non Pers. in J. de Bot., vol. 2, 1809, p. 19) — *Calvatia saccata* (Fr.) Morg. in J. Cincinn. Soc. Nat. Hist., vol. 12, 1890, p. 171; Lloyd, Myc. Notes, vol. 1, 1904, p. 166; Hollós, Gastr. Ung., 1904, p. 86; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 22; Nüesch in Ber. Schweiz. Bot. Ges., vol. 43, 1934, p. 133; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1934, p. 32; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 137; Bottomley in Bothalia, vol. 4, 1948, p. 574 — *Lycoperdon favosum* Oudemans in Ned. Kruidk. Arch., ser. 3, vol. 2, 1902, p. 676 (non (Rostk.) Bon.).

Fungus 6—11 cm high, 3.5—6 cm wide, height-width ratio from $^3/_1$ till $^1/_1$, mostly with a distinct stem, which is longer than the head; stem often somewhat bulbose; sometimes without a distinct stem and then resembling *C. bovista*; transition from stem into head mostly plicate; exoperidium mostly consisting of very fine, stellately placed, small spines, which sometimes have a more granulose or scaly appearance, fugacious; endoperidium olive to umber-brown; soft and thin, especially at the top, at maturity irregularly dehiscent and finally entirely disappearing, so that only the stem remains; gleba olive- to umber-brown; subgleba not sharply separated from the gleba, occupying $^2/_3$ to $^3/_4$ of the total height, cellular, olive- or umber-brown, often somewhat purplish; spores (4,2)4,9—5,6(6,3) μ in diam., globose, strongly warted when wholly mature, often mixed with fallen pedicels; threads of capillitium up to 4,2(5,6; 11,2) μ thick, thinner than the spores, not very strongly ramose — *fig. 3, 4.*

Habitat: especially in deciduous woods, solitary or in groups, from July to Nov. (March, April).

Specimens examined: Gld.: Epe, 1948, *van Kregten* (L); Lage Vuursche, 1948, *Kleijn* (L); Ruurlo, *Agsteribbe*, 1948 (L); Weurt, 1848, *Abeleven* (NBV); Wilp, 1948, *van Heurn* (L); Utr.: Amersfoort, 1917, *van Overeem a. o.* (A); Driebergen (L); N. H.: Bloemendaal, 1915, *Boedijn* (A); Bussum, 1916, *van Overeem a. o.* (A); Haarlem, 1915, *Cool* (L); Hilversum (Spand. Woud), 1915, *de Mol* (A); Muiden, 1915 (A); Vogelenzang, 1874, *de Vries* and *Moll* (GRO); Z. H.: Kijkduin, *de Lint.* (L); Leiden, *Molkenboer* (L); 1847, *Oudemans* (GRO); Lisse, 1915, *van Overeem a. o.* (A); Oegstgeest, 1948, *Maas Geesteranus* 4334 (L); Wassenaar, *Timmermans* (L); (Raaphorst), 1933, *Goddijn* and *Lütjeharms* (L), 1949, *Barkman* (L); (Meyendel), 1949, *Perdeck* 201 (L); Zeel.: Zwake, 1844, *van den Bosch* (L); N. B.: Eindhoven, 1948, *Daams* (L); Oosterhout, 1948, *van Alphen* (L); Limb.: Valkenburg, 1900, *Eick* (GRO).

Distribution: Europe (Sweden, Denmark, England, Netherlands,

Belgium, France, Germany, Austria, Czechoslovakia, Hungary, Rumania, Italy), S. Africa, N. America.

Remarks:

1. This species is sometimes difficult to distinguish from *Lycoperdon molle* Pers., especially young specimens, without a pore and without a distinct stem. *Calvatia excipuliformis*, however, has never a columella nor a purple gleba.

2. Hollós (l. c.) and Nüesch (l. c.) distinguish several varieties but the Netherlands specimens do not allow me to have an opinion about them.

3. The name *Calvatia saccata* (Vahl) Morg., as the species mostly has been called up to this time is not valid. Vahl (Fl. Dan., vol. 7, fasc. 19, 1794, p. 8, tab. 1139) gives no name, neither with his plate, nor in the text; he only cites some phrase-names, one of which begins with: "Lycoperdon saccatum, cinereum polline obscure viridi .....". Persoon was the first to use the name *Lycoperdon saccatum* (J. de Bot., vol. 2, 1809, p. 19) but in another sense, as appears from the type in his herbarium (no. HLB 910. 258—641). This specimen is a form of *Lycoperdon pyriforme* Pers. So the name *L. saccatum*, used by Fries (l. c. 1928) for the species in question is not valid being a later homonym.

4. Persoon (l. c. 1801) called the species *Lycoperdon excipuliforme*. The specimens in his herbarium to be found under this name (no. HLB 910. 258—511 and 910. 258—510) leave no doubt in this respect (Lloyd had already mentioned this on a label when he studied the herbarium Persoon). Therefore the valid name is *Calvatia excipuliformis*.

5. This *Lycoperdon excipuliforme* of Persoon is surely not the *L. excipuliforme* of Scopoli (Fl. Carniolica, 2e ed., 1772, p. 488), by which species very probably was meant *Lycoperdon perlatum* Pers., as among others appears from the quotation of tab. 12, fig. 15 of Vaillant's Botanicon Parisiense (1727).

Probably the same holds for the species which was called *L. excipuliforme* by Hollós (l. c. 1904, p. 103), Morgan (l. c. 1890, p. 14) and Vittadini (l. c. 1843, p. 193) (cf. Lloyd, Myc. Notes, vol. 1, 1904, p. 168, 187; vol. 2, 1906, p. 265).

6. The specimens of *L. macrorhizon* Pers. in the herbarium of Persoon (no. HLB 910. 258—469) show this species to be identical with *Calvatia excipuliformis*. Lloyd already noticed this, as appears from a label written by him. The spores are not wholly ripe, so most of them are not strongly warted. The specimens in the herbarium are the same from which are drawn the figures in J. de Bot.

7. According to Hollós (l. c. p. 164) *Lycoperdon boletoides* Pers. (l. c. 1809, p. 22) is a synonym of the species concerned. In the herbarium of Persoon no material of this species could be found so that this statement could not be checked.

8. Oudemans (l. c., 1902) described a new species: *Lycoperdon favosum*. In the first place this name cannot be used, for it is already known as a synonym of *Calvatia bovista*, viz. *Lycoperdon favosum* (Rostk.) Bon. in Bot. Zeit., vol. 15, 1857, p. 595. Further, the only specimen, which was found by Rick at Valkenburg in 1900 could not be retraced in any of the existing herbaria. Judging from the description and the plate it is a

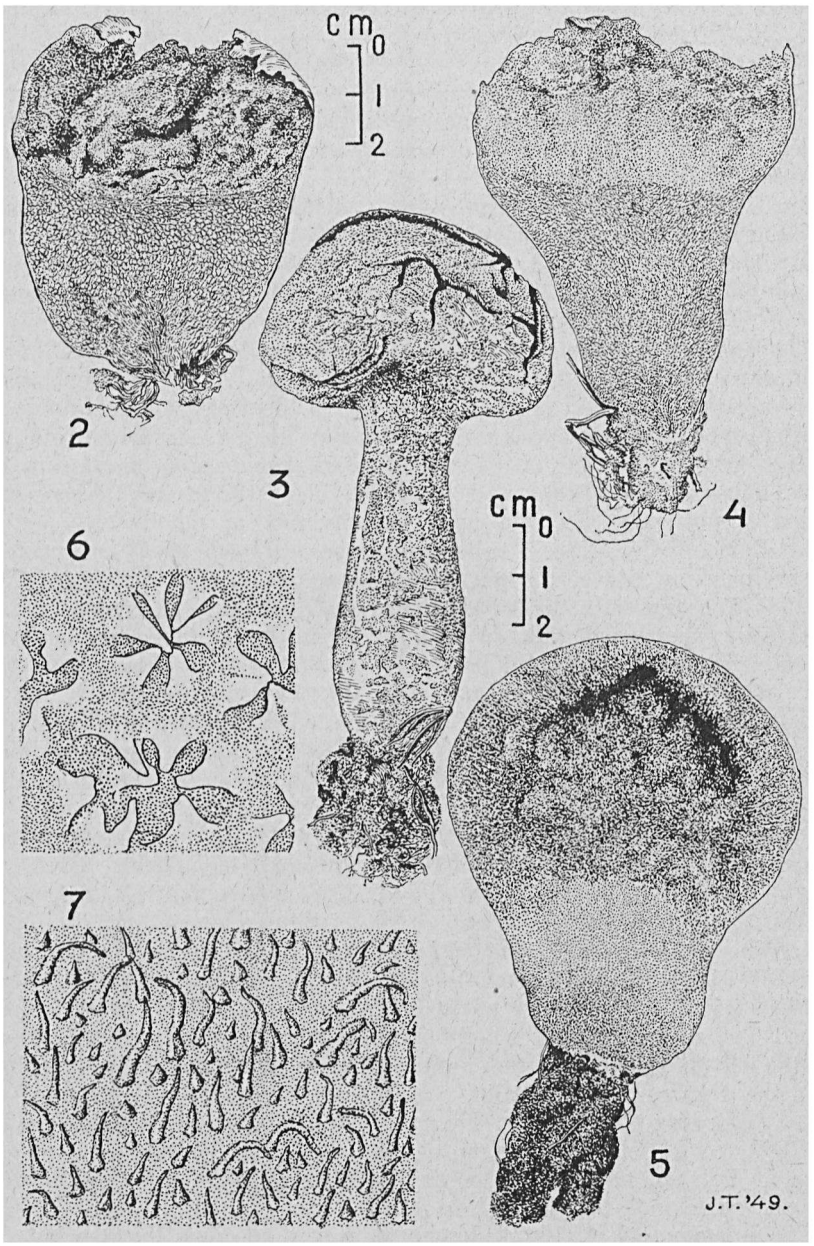

Fig. 2 — *Calvatia bovista* (Pers.) Th. Fr. Jr., longitudinal section; 3 — *C. excipuliformis* (Pers.) Perdeck; 4 — *C. excipuliformis* (Pers.) Perdeck, longitudinal section, nat. size; 5 — *Lycoperdon ericetorum* Pers., large specimen, longitudinal section, nat. size; 6 — *L. candidum* Pers., structure of exoperidium, enlarged; 7 — *L. umbrinum* Pers., structure of exoperidium, enlarged.

Calvatia excipuliformis, which differs only by the indented stem, with some big spines in each dent.

3. LYCOPERDON Pers. emend. Rostk.

in Sturm, Deutschl. Fl., vol. 3, fasc. 18, 1839, p. 2.

Fungus with a more or less distinct stem or sessile, permanently attached to the substratum; exoperidium usually consisting of spines, warts, scales or granules, more or less fugacious; endoperidium persistent, opening by a definite apical pore; columella often present; subgleba mostly present, cellular or compact; spores globose or rarely ellipsoid, smooth or warted; threads of capillitium without a distinct main stem, more or less branched, sometimes septate.

Remarks:

1. The first to use the name *Lycoperdon* in this restricted sense (excluding the species now placed under *Calvatia*) was Rostkovius and not Morgan, as is generally assumed.

2. In the author's opinion it would be preferable to exclude *Lycoperdon depressum* Bon., with its mostly very large pore, and to put it in a new genus characterized by the possession of a diaphragm and the hyaline, septate threads of capillitium.

Key to the species of Lycoperdon.

1a. Subgleba wanting or, if present, compact, not cellular, of the same structure as the gleba.
  2a. Spores with permanent pedicels; very small species, about 0.5—1.0 cm in diam. . . . . **1*. L. echinellum**
  2b. Spores without permanent pedicels; larger species . . . **2. L. ericetorum**
1b. Subgleba present, cellular.
  3a. Spores with permanent pedicels . . . . . **3*. L. pedicellatum**
  3b. Spores without permanent pedicels.
    4a. Diaphragm present; capillitium threads hyaline, septate **4. L. depressum**
    4b. Diaphragm wanting; most of the capillitium threads coloured, not septate.
      5a. Spores, when mature, strongly warted, the warts (at an enlargement of 450 ×) visible along the contour of the spore as a series of fine knots; spores mostly more than 4.5 μ in diam.; gleba mostly purplish when ripe.
        6a. Exoperidium with dark, 3—4 mm long spines, leaving a reticulate structure, when they have fallen off . . . **5*. L. echinatum**
        6b. Exoperidium without such long spines, not leaving a reticulate structure . . . . . **6. L. molle**
      5b. Spores, when mature, smooth or minutely warted, warts not distinctly visible at an enlargement of 450 ×; spores mostly less than 4,5 μ in diam.; gleba never purplish when ripe.
        7a. Exoperidium with distinct spines.
          8a. Exoperidium with white stout convergent spines falling off in plates or patches; gleba and subgleba distinctly separated **7. L. candidum**
          8b. Exoperidium without such spines falling off in patches.
            9a. Spines not fine and slender, or, if so, arranged in small groups and convergent or, after having fallen off, leaving light coloured areoles which form a more or less distinct reticulate structure; columella distinct **9. L. perlatum** [1])

[1]) *L. pyriforme* rarely has distinct spines and in this case it is very difficult to distinguish it from *L. perlatum*.

9b. Spines very fine and slender, dark, crowded, never regularly arranged in groups, reticulated structure always wanting . . . . . 8. **L. umbrinum**

7b. Exoperidium without distinct spines.

10a. Columella very distinct; subgleba white to pale brown, when mature always of a paler colour than the gleba; caespitose, mostly lignicolous . . . . 10. **L. pyriforme**

10b. Columella indistinct; subgleba dark brown or purplish when mature, never of a paler colour than the gleba; not caespitose, terrestrial . . . . . 11. **L. spadiceum**

1*. **Lycoperdon echinellum** (Pat.) Perdeck, nov. comb. — *Bovista echinella* Patouillard in Bull. Soc. Myc. France, vol. 7, 1891, p. 165; Lohwag in Beih. Bot. Centralbl., vol. 51, 1933, p. 269 — *Bovistella echinella* (Pat.) Lloyd, Myc. Notes, vol. 2, 1906, p. 262, 286; vol. 3, 1910, p. 452; vol. 5, 1910, p. 602; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 31.

Distribution: Europe (Sweden, Denmark, Lapland, Austria), N. and S. America. Not yet found in the Netherlands.

Remark: This species has a capillitium of the *Lycoperdon*-type, for which reason it is placed in this genus.

2. **Lycoperdon ericetorum** Pers. in J. de Bot., vol. 2, 1809, p. 17, tab. 2, fig. 1a and b; Hollós, Gastr. Ung., 1904, p. 168, pro syn. — *Lycoperdon furfuraceum* Schaeff. ex Vitt. in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 183, pro syn.; de Toni, in Sacc., Syll. Fung. vol. 7, 1888, p. 110; Hollós, Gastr. Ung., 1904, p. 105; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1932, p. 75 — *Lycoperdon cepaeforme* Bull. ex Pers. in J. de Bot., vol. 2, 1809, p. 17, pro syn.; Morgan, in J. Cincinn. Soc. Nat. Hist., vol. 14, 1891, p. 20 — *Lycoperdon polymorphum* Vitt., Mon. Lyc., 1842, p. 39; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 183; Lloyd, Myc. Notes, vol. 1, no. 16, 1904, p. 167; Myc. Notes, vol. 2, no. 19, 1905, p. 215; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 47; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 29; Cunningham in Proc. Linn. Soc. N. S. Wales, vol. 51, 1926, p. 635; Gaster. Austr., 1942, p. 151 — *Lycoperdon pusillum* Pers. in J. de Bot., vol. 2, 1809, p. 17; Fries, Syst. Myc., vol. 3, 1829, p. 33; Hollós, Gastr. Ung., 1904, p. 107; Lloyd, Myc. Notes, vol. 1, no. 16, 1904, p. 167; Myc. Notes, vol. 2, no. 19, 1905, p. 216; Petri, Fl. Ital. Crypt, pars 1, fasc. 5, 1909, p. 48; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 29; Cunningham in Proc. Linn. Soc. N. S. Wales, vol. 51, 1926, p. 636; Gaster. Austr., 1942, p. 152; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1932, p. 76 — *Lycoperdon dermoxanthum* Vitt. Mon. Lyc., 1842, p. 34; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 178.

Fungus 0,8—3,5 (6) cm high, 0,7—3 (5) cm wide; height-width ratio mostly $^1/_1$, sometimes up to $^1/_2$; very variable; globose or more depressed, sessile or pear-shaped with a more or less distinct stem; exoperidium when immature white, yellowish or grey, turning darker when mature, consisting of a coat, which is divided in small fields by little cracks, or of granules, small scales or very fine short small spines; in old specimens these structures may have colours varying from white to almost black and are fairly persistent; endoperidium bright to dark brown, often reddish at the base, typically papery cracking when mature; pore 2—8 mm in diam., often

mammose; gleba olive- or umber-brown, when mature, rarely with a faint columella; subgleba often absent; when present gradually passing over into the gleba, occupying up to $^1/_2$ of the total height; structure very much the same as in the gleba, not cellular, fibrillous, white, yellowish or umber-brown; roots fairly strongly developed; spores globose and (3,1) 3,8—4,5 (5,2) μ in diam. or broadly ellipsoid, 4,5—5,2 μ long and 3,5—4,2 μ wide, smooth or finely verrucose; threads of capillitium to 6,3 (9,8; 14,0) μ thick, coloured, strongly ramose — *fig. 5.*

Habitat: in open fields or in woods (both coniferous and deciduous woods), specially on sand, mostly on dry, but also on moist ground; growing mostly in small groups or clusters, from July to Nov. (Dec., Febr.).

Remarks:

1. Most authors consider specimens without a subgleba to be a distinct species, *Lycoperdon pusillum* Pers. I cannot agree with this, for Persoon (1809) distinguishes *L. pusillum* only by its small size. However I found all transitions between big and small specimens, even growing on the same spot. Most of the later authors (of whom Vittadini, 1842, was the first) give the absence of the subgleba as a decisive character of *L. pusillum.* Concerning this character, too, I found all stages between the absence and the strong development of the subgleba in specimens of one locality; moreover Persoon's herbarium contains specimens, named *L. ericetorum,* with and without a subgleba. The microscopical differences between *L. pusillum* and *L. ericetorum,* given by Petri (1909) could not be confirmed.

2. Persoon's description, plate and herbarium specimens show that he meant with his *L. ericetorum* only the sessile, subglobose specimens. Vittadini (1842) had already proved that pear-shaped somewhat stemmed specimens belong also to this species.

3. The valid name of this species is *L. ericetorum* Pers. (1809) which is proved by the very good specimens in Persoon's herbarium (no. HLB 910. 258—491; HLB 910. 258—502; HLB 910. 258—514). In his collection there is also a specimen (no. HLB. 910. 258—470) with a more or less distinct stem under the name L. molle. It is clear that Persoon was here mistaken (cf. remark 2 and p. 500).

4. With regard to the much used name *L. furfuraceum,* it is possible that Persoon with his *Bovista? furfuracea* (Syn. Fung., 1801, p. 138) meant what he later called *L. ericetorum.* But there is so little evidence for this viewpoint that I think it would be better not to use the name *L. furfuraceum* (which is cited by Persoon as a synonym of this *Bovista? furfuracea*). The same holds for his *Bovista pusilla,* l. c. and his later *L. pusillum.*

5. The name *L. cepaeforme* of Bulliard (Hist. Champ. vol. 1, 1791, p. 148) must be rejected, for Persoon gives it as a synonym of his *L. pratense* (Syn. Fung. 1801, p. 142) and afterwards (1809) as a synonym of *L. ericetorum* (l. c. 1809).

6. *L. dermoxanthum* Vitt., which is a synonym of *L. pusillum* according to Lloyd, who saw the type-specimen (Myc. Notes, vol. 7, 1923, p. 1222), must now be considered as a synonym of *L. ericetorum,* just as is true of the name *L. polymorphum* under which Vittadini has given a very good description of the species in question.

7. The specimens called *L. pusillum* Batsch by Westendorp (Prod. Fl. Bat., vol. 2, pars 4, 1866, p. 14) appeared to be *L. ericetorum* Pers. The specimens called *L. aestivale* Bon. by Oudemans (Arch. Néerl., vol. 8, 1873, p. 253; vol. 15, 1880, p. 372) and *L. vittadinii* Mass. (Rév. Champ., 1892, p. 468; Cat. rais., 1904, p. 40) are also *L. ericetorum* Pers. The same holds for one specimen, called by Oudemans *L. serotinum* Bon. (l. c. 1873, p. 23, l. c. 1880, p. 373), but I could not decide this regarding the specimen cited under this name by him in Ned. Kruid. Arch., ser. 3, vol. 2, 1903, p. 200 and by C. Destrée in Handl. Hogere Zwammen, 1901, p. 299, for it has apparently disappeared.

Key to the varieties.

1a. Spores globose . . . . . var. **typicum**
1b. Spores broadly ellipsoid . . . . . var. **oblongisporum**

Lycoperdon ericetorum Pers. var. **typicum** — for synonyms see above.

Spores globose, (3,1) 3,8—4,5 (5,2) μ in diam.

Specimens examined: Gld.: Nunspeet, 1900, *Beins* (GRO); Nijmegen, 1948, *Schweers* (L); Wilp, 1949, *van Heurn* (L); Utr.: Doorn, 1869, *Oudemans* (L, GRO, U); Lage Vuursche, 1948, *Kleijn* (L); Zeist, 1884, *Oudemans* (L); N. H.: Amsterram (A'damse bos), 1948, *Agsteribbe* (L); Bloemendaal, 1915 (L); Bussum, 1916, 1917, *van Overeem a. o.* (A); Castricum, 1914, *van Overeem* (A); Haarlem, *Splitgerber* (L); 1916, *Cool* (L); Leyduin, 1916, *van Overeem a. o.* (A); Vogelenzang, 1914, *Cool* (L); Z. H.: Dordrecht, 1949, *Kinstra* (L); Katwijk, 1845, *Perin* (L); Leiden, 1835, *Arcenhausen* (L); *Molkenboer* (L); Noordwijk, 1948, *van Ooststroom* 11039 up to 11042 incl. (L); Wassenaar, 1865, *Perin* (L); (Duinrell), 1945, *exc. N. N. V.* (L); 1948, *Vervoort* (L); 1948, *van Ooststroom* 11057 (L); 1948, *Perdeck* 152 up to 154 incl., 183 up to 185 incl. (L); (Meyendel), 1926, *Hoogland, P. J.* (L); (Rust en Vreugd), 1949, *van Ooststroom* 12428 (L); (Voorlinden), 1948, *Maas Geesteranus* 4339, 4340, 4342 (L); 1948 *Perdeck* 190, 191 (L); N. B.: Bergen op Zoom, 1901, *La Fontijn* (GRO); Breda, 1865, *Nagelvoort* (GRO); Drimmelen, 1949, *Kenniphaas* (L); Zeel.: Renesse, 1949, *Hoogland, R.*, 2000 (coll. Hoogland).

Distribution: Europe (Sweden, England, Netherlands, Belgium, France, Germany, Austria, Czechoslovakia, Hungary, Rumania, Portugal, Italy), S. Africa, N. America, Australia.

Lycoperdon ericetorum Pers. var. **oblongisporum** (B. et C.) Perdeck nov. comb. — *Lycoperdon oblongisporum* B. et C. in J. Linn. Soc., vol. 10, 1867, p. 345; Massee in J. Roy. Micr. Soc., 1887, p. 723; Morgan, in J. Cincinn. Soc. Nat. Hist., vol. 14, 1891, p. 19; Hollós, Gastr. Ung., 1904, p. 115; Lloyd, Myc. Notes, vol. 2, 1905, p. 235; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 148.

Spores broadly ellipsoid, 4,5—5,2 μ long, 3,5—4,2 μ wide.

Specimens examined: Z. H.: Wassenaar (Duinrell), 1948, *Perdeck* 182 (L).

Distribution: Europe (Netherlands, Hungary), America.

Remarks:

1. Differs from var. *typicum* only by the ellipsoid spores. Therefore I consider it as a variety of *L. ericetorum*.

2. Bottomley (in Bothalia, vol. 4, 1948, p. 558) states that the specimens of *L. ericetorum* (called by him *L. polymorphum*) found in S. Africa are mostly subglobose to broadly oval. In my opinion these specimens also belong to this variety.

3*. **Lycoperdon pedicellatum** Peck. in N.-York State Mus. Rep. 26, 1874, p. 73; l. c. 32, 1879, p. 68; Hollós, Gastr. Ung., 1904, p. 114; Killer-

mann, Krypt. Forsch., vol. 1, 1926, p. 507; Schwarz in Am. J. Bot. vol. 23, 1936, p. 4; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 144 — *Lycoperdon caudatum* Schroeter in Cohn, Krypt. Fl. Schles. vol. 3[1], 1889, p. 698 — *Bovistella pedicellata* (Peck) Lloyd, Myc. Notes, vol. 2, 1906, p. 262, 282; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 30.

Distribution: Europe (Sweden, Germany, Hungary), N. America. Not known from the Netherlands.

4. Lycoperdon depressum Bon. in Bot. Zeit., vol. 15, 1857, p. 611; Oudemans in Arch. Néerl., vol. 8, 1873, p. 253; vol. 15, 1880, p. 370; Rév. Champ., 1892, p. 469; Cat. rais. 1904, p. 38; Cunningham in Proc. Linn. Soc. N. S. Wales, vol. 51, 1936, p. 630 — *Lycoperdon caelatum* Fr., Syst. Myc., vol. 3, 1829, p. 32 (non Bull. ex Pers., Syn, Fung., 1801, p. 141, pro syn.) — *Lycoperdon hyemale* Bull. ex Vitt., Mon. Lyc., 1842, p. 46; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 190; Hollós in Termész. Füz., vol. 25, 1902, p. 108; Gastr. Ung., 1904, p. 170; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1932, p. 77; Cunningham, Gaster. Austr., 1942, p. 146; Bottomley in Bothalia, vol. 4, 1948, p. 551 — *Lycoperdon pratense* Lloyd, Myc. Notes, vol. 1, Lyc. Austr., 1905, p. 31; vol. 2, 1905, p. 213; vol. 2, 1906, p. 249; vol. 3, 1909, p. 439; T. C. E. Fries in Ark. f. Bot., vol. 7, no. 9, 1921, p. 36.

Fungus 1—5 cm high, 1,5—6 cm wide, height-width ratio most variable, from $^{7}/_{4}$ to $^{2}/_{5}$; upper side nearly always more or less flat, gradually, sometimes suddenly narrowing into the more or less stem-like base, sometimes sessile, subglobose or depressed; surface towards the base more or less plicate, wrinkled or indented; exoperidium consisting of fairly fugacious, white or yellowish spines, mealy granules or small scales; spines very small, often clustered and connivent; endoperidium becoming more visible in adult specimens, smooth and shiny, light brown; pore at first small, and sometimes remaining so, mostly becoming gradually larger, at last occupying half of the diameter of the upper side or more, margin irregularly torn; gleba olivaceous or umber-brown when ripe, without columella, pulverulent, easily loosening from the diaphragm; diaphragm very distinct, already present in young specimens; subgleba occupying from $^{1}/_{3}$ to $^{2}/_{3}$ of the total height, cellular, white to yellowish or dark purple-brown when fully ripe; cells near diaphragm not differing from those below; spores (3,1) 3,5—4,2 (4,5) μ in diam., globose, smooth or very finely verrucose; capillitium threads up to 5,6 (8,1) μ thick, hyaline, septate, thin-walled, flaccid, mostly granular, sparingly branched.

Habitat:: growing solitary or in groups (also caespitose according to Bottomley l. c.) from July to Oct. (Febr.) amongst grass in pastures and way-sides, also found on heath; on clay, sand or calcareous soil, both moist as well as dry; sometimes in deciduous woods.

Specimens examined: Gr.: Harendermolen, 1824 or 1829, *van Hall* (L); Ov.: Beuningen, 1948, *van Steenis* (L); Enschede, 1948, *Middelhoek* (L); Gld.: Amersfoort, 1917, *van Overeem a. o.* (A); Ede, 1948, *Kleijn* (L); Epe, 1948, *van Kregten* (L); Heelsum, 1848, *Buse* (L); Nunspeet, 1900, *Beins* (GRO); Putten, 1884, *Oudemans* (L); Ruurlo, 1948, *Agsteribbe* (L); Weurt, 1848, *Abeleven* (L); Wilp, 1947, 1948, *van Heurn* (L); Utr.: Doorn, 1869, *Oudemans* (L, GRO, U, NBV); Leersum, 1916, *Cool* (L); N. H.: Amsterdam (A'damse bos), 1948, *Agsteribbe* (L); (IJselmeerdijk), 1948, *Agsteribbe* (L); Bussum, 1902, *Koning* (GRO); Castricum, 1914, *van Overeem* (A);

Muiden, 1853, *van der Sande Lacoste* (L); Sloten, 1853, *van der Sande Lacoste* (L): Z. H.: Dordrecht, 1949, *Kinstra* (L); 's Gravenhage, 1845, *Schuurmans Stekhoven* (L): Kijkduin, *de Lint* (L); Leiden, 1944, 1949, *Perdeck* (L); 1948, *Willemse* (L); Maassluis, 1949, *Masseling* (L); Oegstgeest, 1949, *van Ooststroom* 12436, 12442 (L); Rijpwetering, 1949, *van der Heyden* (L); Voorne (Kwakjeswater) 1915, *Goethart* (L); Wassenaar, 1945, *L. B. C.* (L); 1948, *Perdeck* (L); (Rust en Vreugd), 1949, *van Ooststroom* 12433 (L); Zoeterwoude, 1944, *Perdeck* (L); Zeel.: Goes, 1845, *van den Bosch* (L); N. B.: Bergen op Zoom, 1900, *La Fontijn* (GRO); Drimmelen, 1949, *Kenniphaas* (L); Eindhoven, 1948, *Daams* (L); Scheldedijk, 1901, *La Fontijn* (GRO); Limb.: Bemelen, 1948, *Perdeck* 151 (L); Valkenburg, 1900, *Rick* (Maastr.).

Distribution: Europe (Sweden, Denmark, England, Netherlands, Belgium, France, Germany, Austria, Hungary, Rumania, Portugal, Italy)), S. Africa, N. America, Australia, Asia.

Remarks:

1. Bulliard (Hist. Champ., vol. 1, 1791, tab. 72) was the first to recognise this species, drawing attention to the diaphragm. He named the species *L. hyemale,* but since this name was published before the "starting point" (1901) it is not valid.

2. Persoon fails to give a clear description of the species. However, I found it on two sheets in his herbarium: 1. under the name *Lycoperdon candidum* (no. HLB 910. 258—507), 2. under the name *Lycoperdon hirtum* B. (no. HLB 910. 256—1273).

As to *L. candidum,* it may be stated that in his herbarium there is a second specimen under this name (no. HLB 910. 258—497), which is most certainly not *L. depressum.* This specimen is to be considered as the type of *L. candidum* Pers. (for argumentation see under this species, remark 1). So the former specimen has to be regarded as incorrectly identified.

As regards *L. hirtum,* this name cannot be used, for it is a later homonym. Persoon first used it as a synonym of *L. umbrinum* (Syn. Fung., 1801, p. 148). In 1809, however, he published it as a new species (J. de Bot., vol. 2, 1809, p. 20).

3. The same holds for the name *L. caelatum,* under which E. Fries describes the species (1829), for Persoon cites it as a synonym of his *L. bovista* (Syn. Fung., 1801, p. 141).

4. Vittadini (1843) adopts the name of Bulliard, *L. hyemale* (however, he writes "hiemale"), and gives a very good description under this name. Persoon gives this name as a synonym of his *L. plicatum* (J. de Bot., vol. 2, 1809, p. 21) and therefore it must also be rejected.

5. Bonorden (1857) calls the fungus *Lycoperdon depressum* which is the valid name.

6. Lloyd calls the species *L. pratense* Pers. Because Persoon left no specimens under this name (except some with a question-mark) and his description (Syn. Fung. 1801, p. 142) gives no decision, this is not to be recommended and it is better rejected (see under *L. candidum* Pers., remark 2).

5*. **Lycoperdon echinatum** Pers., Syn. Fung., 1801, p. 147; in J. de Bot., vol. 2, 1809, p. 22; Hollós, Gastr. Ung., 1904, p. 95; Lloyd, Myc. Notes, vol. 2, 1905, p. 208, 222; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 42; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 25;

Killermann, Krypt. Forsch., vol. 1, 1926, p. 503 — *Lycoperdon constellatum* Fr., Syst. Myc., vol. 3, 1829, p. 39.

Distribution: Europe (Sweden, England, France, Germany, Hungary, Italy), N. America.

Remarks:

1. This species has not yet been found in the Netherlands. All cases in which its occurrence in this country is claimed and in which I was able to examine the specimens in question, appeared to be *Lycoperdon perlatum* Pers., mostly var. *nigrescens* Pers.

2. In the herbarium of Persoon good specimens of this species are present. Lloyd has indicated no. HLB 910. 258—504 as the type.

6. **Lycoperdon molle** Pers., Syn. Fung., 1801, p. 150; in J. de Bot., vol. 2, 1809, p. 18 (non Trelease in Trans. Wiscons. Ac., vol. 7, 1889, p. 115; Morgan in J. Cincinn. Soc. Nat. Hist., vol. 14, 1891, p. 17; Hollós, Gastr. Ung., 1904, p. 112; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 39) — *Lycoperdon quercinum* Pers., Syn. Fung., 1801, p. 148; in J. de Bot., vol. 2, 1809, p. 18 (pro syn.) — *Lycoperdon turbinatum* Pers. in J. de Bot., vol. 2, 1809, p. 18 — *Lycoperdon atropurpureum* Vitt., Mon. Lyc., 1842, p. 42; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 186 — *Lycoperdon umbrinum* Hollós, Gastr. Ung., 1904, p. 96; Lloyd, Myc. Notes, vol. 2, no. 19, 1905, p. 209; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 25; Nüesch, Jahrb. St. Gall. Nat. Ges., vol. 65, 1929—1930, p. 123 (non Pers., Syn. Fung., 1801, p. 147; Icon. pict. fung., vol. 3, 1803, p. 43, tab. 18, fig. 3; in J. de Bot., vol. 2, 1809, p. 19).

Fungus 2,5—8 cm high, 2,5—6 cm wide, height-width ratio from $^2/_1$ to $^1/_1$; mostly gradually narrowing into the stem, pear-shaped, but sometimes sessile or with a distinct stem, with all transitions between these extremes; exoperidium mostly consisting of white or brownish, fine, stellately clustered small spines, or of granules of varying proportion; often with combinations of or transitions between spines and granules; endoperidium smooth, tender, yellowish or brown; pore irregular, up to ± 5 mm in diam.; gleba umber- or purplish-brown when mature, sometimes with a more or less distinct columella; subgleba not sharply separated from the gleba, occupying $^1/_5$ to $^2/_3$ from the total height, cellular, pale brown or purplish brown (when mature); spores 4,2—5,6 (6,3) μ in diam., globose, strongly warted when mature (at an enlargement of 450 × the warts are already distinctly visible); often mixed with fallen pedicels; threads of capillitium to 5,6 (7,0) μ thick, coloured, mostly pretty strongly ramose.

Habitat: in several types of woods, solitary or in groups from Aug. to Oct.

Specimens examined: Gld.: Nunspeet, 1898, *Beins* (GRO); Oosterbeek, 1948, *Gremmen* (L); Ruurlo, 1948, *Agsteribbe* (L); N. H.: Bussum, 1916, 1917, *van Overeem* a. o. (A); Haarlem, *Splitgerber* (L); Z. H.: Kijkduin, *de Lint* (L); Wassenaar (Duinrell), 1948, *Perdeck* 155, 161, 168 (L); N. B.: Eindhoven, 1948, *Daams* (L); Limb.: Valkenburg, 1900, *Rick* (GRO); Vlodrop, 1948, *Holthuis* (L).

Distribution: Europe (Sweden, Netherlands, France, Germany, Austria, Czechoslovakia, Hungary, Rumania, Portugal, Spain, Italy), S. Africa, N. America.

Remarks:

1. This species is sometimes difficult to distinguish from *Calvatia excipuliformis*, which, however, never has a purple gleba and a columella.

2. Several authors (e. g. Lloyd, Myc. Notes, 1905, p. 209—210; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1932, p. 76; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 142—143) distinguish a number of allied species, which are only varieties according to Hollós (l. c.) and Nüesch (l. c.). *Lycoperdon velatum* Vitt., however, seems to me to be a distinct species (see especially Lohwag in Beih. Bot. Centralbl., vol. 51, 1933, p. 274). It is characterised by the soft white veil, which completely covers the plant in early stages and, as the plant develops, breaks up into ragged pieces which partly adhere loosely to the endoperidium or finally fall away. It is found in Europe (Italy, Austria, Hungary, France) and N. America.

3. In Persoon's herbarium there are six numbers of *L. molle*, with a label of Persoon (and without a question-mark). One of these (no. HLB 910. 258—463) is immature and therefore not recognisable; another one (no. HLB 910. 258—466) is *L. perlatum*. Here an accidental change of labels must have occurred, for I found another specimen of the species in question under the name *L. perlatum* (no. HLB 910. 258—472, already discovered by Lloyd; cf. also Myc. Notes, vol. 2, 1905, p. 209 note). Of the four remaining specimens one is *L. ericetorum* Pers. (specimen with stem!) (no. HLB 910. 258—470) and the three others (no. HLB 910. 258—467, 910. 258—468, 910. 258—472) belong to the species with which we are dealing here (purple gleba; strongly warted spores). Since the name is properly published, the valid name is *Lycoperdon molle* Pers. Lloyd (Myc. Notes, vol. 2, 1907, p. 345), after his visit at Leyden, came to the same conclusion, but did not use this name.

4. The specimens Persoon left of his *L. turbinatum* (no. HLB 910. 258—649) prove that this species is the same as *L. molle*. Persoon himself had noted already on the label under the first name: "*L. mollis* varietas?" Lloyd came to the same conclusion, as appears from a label written by him.

5. *L. quercinum* Pers. (1801) is synonymous with *L. molle* according to the author himself (1809). He left no material under this name.

6. Vittadini (1842) was the first to give a clear description of the species under the name *L. atropurpureum*, of which Lloyd has seen the type (Myc. Notes, vol. 7, 1923, p. 1222).

7. Up to this time the species has generally been known under the name *L. umbrinum* Pers. It was so called for the first time by Hollós (1904), who based his conclusion on Persoon's descriptions and picture of this species. This is not right, for the type specimen of *L. umbrinum* (see under this species, p. 503), though mature, shows only finely verrucose spores, and no purple gleba.

8. What was called *Lycoperdon molle* Pers. by Trelease (1889), Morgan (1891), Hollós (1904) and Petri (1909) is not this species, but judging from the descriptions, *L. spadiceum* Pers.

9. Very probably Oudemans (Rév. Champ., 1892, p. 467, Cat. rais.,

1904, p. 39) called this species *L. hirtum* Mart., judging from his description, for he left no cited material under this name.

7. **Lycoperdon candidum** Pers., Syn. Fung., 1801, p. 146; Icon. et Descr. Fung., vol. 2, 1798—1800, p. 53, tab. 13, fig. 4; in J. de Bot., vol. 2, 1809, p. 22 — *Lycoperdon cruciatum* Rostk. in Sturm, Deutschl. Fl., vol. 3, fasc. 18, 1839, p. 19, tab. 8; Lloyd, Myc. Notes, vol. 1, 1902, p. 83, 112; vol. 2, 1905, p. 214, 231 — *Lycoperdon marginatum* Vitt., Mon. Lyc., 1842, p. 41; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 185; Lloyd, Myc. Notes, vol. 1, 1902, p. 112; vol. 7, 1923, p. 1222; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 41; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 143 — *Lycoperdon separans* Peck in N. York Nat. Hist. Mus., vol. 26, 1874, p. 73; Morgan, in J. Cincinn. Soc. Nat. Hist., vol. 14, 1891, p. 14; Lloyd, Myc. Notes, vol. 1, 1902, p. 83 — *Lycoperdon Wrightii* B. et C. var. *separans* Peck in N. York Nat. Hist. Mus., vol. 29, 1878, p. 67; Lloyd, Myc. Notes, vol. 1, 1903, p. 153; vol. 2, 1905, p. 232 — *Lycoperdon papillatum* Schaeff. ex Hollós, Gastr. Ung., 1904, p. 108; Killermann, Krypt. Forsch., vol. 1, 1926, p. 506.

Description partly after Morgan and Hollós.

Fungus 1,0—2,5 cm high, 1,2—5 cm wide, subglobose hemispheric, often depressed; exoperidium (*fig. 6*) consisting of a dense coat of white, stout spines, convergent at the apex in little groups, becoming smaller at the base, falling off in irregular patches at maturity; endoperidium thin, mealy, at last smooth and shiny, yellowish or pale brown; gleba pale or dark brown, mostly without a distinct columella; subgleba pretty sharply separated from the gleba, but without diaphragm, occupying from $^1/_5$ to $^1/_3$ of the total height, sometimes scanty, cellular; spores 3,5—4 μ in diam. globose, smooth; threads of capillitium 2,1—4,9 μ thick, coloured, not or hardly branched.

Habitat: on grass-fields, sometimes on stumps, July, August; rare.

Specimens examined: only one specimen has been found in the Netherlands: Gld.: Hoenderlo, Aug. 1877, *Oudemans* (L).

Distribution: Europe (Netherlands, France, Germany, Austria, Hungary, Italy), N. America.

Remarks:

1. Persoon has left in his herbarium two sheets with specimens of this species. To one of them, no. HLB 910.258—501, he has written: "*Lycoperd. depressum* spec. nova?", but he never published it under this name. As appears from a label, Lloyd already identified the specimens as *L. cruciatum* and he added: "It is I think *L. candidum* of Pers. Icon." cf. Myc. Notes, vol. 2, 1907, p. 345. The other one, no. HLB 910.258—497 bears the name *Lycoperdon candidum*, with the note "Syn. fung. p. ... et Icones fungor. Fasc. t. ...", all written by Persoon. Now there are in his herbarium two other sheets bearing the name *L. candidum* in Persoon's handwriting. One, no. HLB 910.258—507, is *L. depressum* Bon., the other, found in N. America, no. HLB 911.18—197, *L. wrightii* B. et C. (var. *typicum* Peck). (For further particulars about the latter species, which according to Hollós is identical with *L. depressum* Bon., see Lloyd, Myc. Notes, vol. 2, 1905, p. 232, 1906, p. 271; 1907, p. 324). On the label of this specimen Persoon wrote "*Lycoperdon candidum* Syn. fung. Am.

Bor." Of these three different species, all bearing the name *L. candidum*, in my opinion no. HLB 910.258—497, must be considered as the real *L. candidum* Pers., and therefore becomes the type-specimen. I base this viewpoint on his description and especially on the figures in Icon. et Descr. Fung., l. c. These illustrations show a *Lycoperdon* with stout, white convergent spines, just as they are characteristic for the species under discussion. Furthermore, the figures resemble exactly the last-mentioned specimen, not the other specimens which are *L. depressum* and *L. wrightii*. The valid name of the species in question therefore is now *Lycoperdon candidum* Pers. Lloyd, Myc. Notes, vol. 2, 1905, p. 215, came to the same conclusion, stating: "Everything points to *L. candidum* of Persoon". It was, however, not correct for Lloyd to state that there are no specimens under this name in Persoon's herbarium (Myc. Notes, vol. 2, 1907, p. 345).

2. Hollós, l. c., calls the species *L. papillatum* Schaeff., and gives as a synonym among others *L. pratense* Pers., most probably because Persoon, in his description of *L. pratense*, gives *L. papillatum* Schaeff. as a synonym (Syn. Fung., 1801, p. 142). However, to judge from his description, Persoon meant something else with *L. pratense*, for he states about the spines: "verrucae obsoletae" and "verrucis parcis" whereas *L. candidum* has always very distinct spines. So, if *L. papillatum* Schaeff. is considered identical with *L. candidum*, *L. pratense* cannot be a synonym of *L. candidum*. There are more reasons not to use the name *L. pratense* (see under *L. depressum* Bon., remark 6).

3. The only known specimen found in the Netherlands was identified by Oudemans as *L. gemmatum* Batsch. var. *papillatum* Schaeff. (Arch. Néerl., vol. 15, 1880, p. 373). Of the other material, cited to have been found in Westland, no specimens are left (also cited in Prodr. Fl. Bat., vol. 2, pars 4, 1866, p. 13; Ned. Kruidk. Arch., ser. 2, vol. 5, 1891, p. 370).

8. Lycoperdon umbrinum Pers., Syn. Fung., 1801, p. 147; Icon. pict., 1803, p. 43, tab. 18, f. 3; in J. de Bot., 1809, p. 19 (non Hollós, Gastr. Ung., 1904, p. 96; Lloyd, Myc. Notes, vol. 2, no. 19, 1905, p. 209; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 25; Nüesch, Jahrb. St. Gall. Nat. Ges., vol. 65, 1929—1930, p. 123).

Fungus 2—4,5 cm high, 1,5—3 cm wide, height-width ratio $^1/_1$ to $^3/_2$; more or less pear-shaped, stem distinct or not; exoperidium (*fig. 7*) consisting of very small, slender, dark spines, which nearly cover the whole surface; spines mostly different in length, with a somewhat thickened persistent base, often several spines connivent at the apex, but never regularly placed in groups, and never leaving bright areoles when they have fallen off; endoperidium white or yellowish brown, shiny; pore not very regular, 4—5 mm in diam.; gleba olive or umber brown, with a more or less distinct columella; subgleba unsharply separated from the gleba, occupying $^2/_5$ to $^3/_5$ of the total height, cellular, whitish, dark or purplish brown; root consisting of small, ramose fibres; spores 3,5—4,5 μ in diam., smooth or finely verrucose, globose; threads of capillitium up to 4,2 (5,6) μ thick, coloured, not very strongly ramose.

Habitat: in woods, mostly solitary, Aug. to Oct.

Specimens examined: Gld.: Brummen, 1861, *Oudemans* (GRO); N.B.: Boxtel-Best, 1946, *Maas Geesteranus* 3429 (L); Eindhoven, 1946, *Maas Geesteranus* 3432 (L); 1948, *Daams* (L).

Distribution: since the author does not know under which names this species is given by others, he cannot say anything about the distribution.

Remarks:

1. The species is sometimes difficult to be distinguished from *L. perlatum*. Note the less distinct columella and structure of the exoperidium.

2. Thanks to the presence of one specimen under the name *L. umbrimum*, written by Persoon, in his herbarium (no. HLB 911.81—14), which is to be considered as the type-specimen, I could establish with certainty what Persoon understood by this species. It appeared that Persoon's descriptions and figure of this species are always misunderstood. What now is to be called *L. molle* Pers. (see also under this species) was called *L. umbrinum* Pers. by Hollós and other authors. Decisive are the but finely verrucose spores and the brown, not purple gleba of the type.

3. It is probable that this is the species called by Hollós (Gastr. Ung., 1904, p. 104) and Lloyd (Myc. Notes, vol. 2, 1905, p. 210, 227) *L. fuscum* Bon. However, Hollós speaks of white spines, and Lloyd of rough spores. Bonorden's description (Bot. Zeit., vol. 15, 1857, p. 626) gives no solution and his specimen in Fuckels herbarium, which according to Lloyd might be the type-specimen, has been identified by the same to be *Lycoperdon spadiceum* (Myc. Notes, vol. 2, 1906, p. 291).

9. **Lycoperdon perlatum** Pers., Syn. Fung., 1801, p. 145; in J. de Bot., vol. 2, 1809, p. 20; Vittadini, Mon. Lyc., 1842, p. 50; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 194; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 27; Cunningham in Proc. Linn. Soc. N. S. Wales, vol. 51, 1926, p. 633; Gaster. Austr., 1942, p. 149; Kambly and Lee, in Univ. of Iowa Stud., vol. 17, 1936, p. 146; Bottomley in Bothalia, vol. 4, 1948, p. 554 — *Lycoperdon gemmatum* Fries, Syst. Myc., vol. 3, 1829, p. 36; Westendorp in Prodr. Fl. Bat., vol. 2, pars 4, 1866, p. 13; Oudemans in Arch. Néerl., vol. 15, 1880, p. 372; Rév. Champ., 1892, p. 469; Cat. rais., 1904, p. 39; Hollós, Gastr. Ung., 1904, p. 102; Lloyd, Myc. Notes, vol. 2, 1905, p. 211; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 38; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1932, p. 72 — *Lycoperdon tasmanicum* Mass., in Kew Bull., 1901, p. 158 — *Lycoperdon macrogemmatum* Lloyd, Myc. Notes, vol. 2, 1906, p. 265 — *Lycoperdon turbinatum* Lloyd, Myc. Notes, vol. 4, 1906, p. 265 (non Pers., non B. et C.).

Fungus 1,2—6,5 cm high, 1,1—5,5 cm wide, height-width ratio $^1/_2$ to $^2/_1$, very variable, sessile or with a more or less distinct stem, often plicate between head and stem; exoperidium always with distinct spines; mostly there is an increasing difference in length between the spines from the base upwards to the apex of the fungus; the big spines each being surrounded by a ring of small ones are deciduous, leaving a pale areole when they have fallen off, whereas the small spines do not fall off so easily; in this way the exoperidium forms a typical reticulate structure (*fig. 9*). Instead of one big spine there are often a number of them, mostly 4—6. They are more or less grown together, and may be connected only at the base and the apex; they fall off together and as a group are surrounded by small ones (*fig. 11*); this reticulate structure is mostly very distinct, only being indistinct in var. *bonordeni*, whereas it is hardly developed at

all in young specimens; the shape of the spines is very different; colour white, yellow, brown or almost black; endoperidium white, yellow or pale brown; pore 3—6 (10) mm in diam., mostly regular; gleba olive or umber brown when mature, always with a distinct, mostly very regular columella; subgleba often fairly well separated from the gleba, occupying $^4/_5$ to $^1/_4$ of the total height; cellular, white or pale brown; root mostly not very strongly developed, sometimes a group of specimens, as a rule young ones, connected by white cord-like roots, just as in *L. pyriforme* Pers.; spores 3,5—4,5 (4,9) μ in diam., globose, finely warted; threads of capillitium up to 4,5 (5,6) μ thick, coloured, often granular, mostly little branched; often mixed with hyaline, septate threads — *fig. 8.*

Habitat: nearly always in woods of several types; mostly caespitose, but also in groups or solitary; July to Nov. (March).

Distribution: Europe (Sweden, Denmark, England, Netherlands, Belgium, France, Germany, Switzerland, Austria, Hungary, Rumania, Portugal, Italy), Africa, America, Australia.

Remarks:

1. The specimens in Persoon's herbarium leave no doubt that his *L. perlatum* is the species we are dealing with (see e. g. the specimens no. HLB 910.258—678, 910.258—676, 910.258—671). Persoon already used the name *L. gemmatum* as a synonym in his works.

2. The great variability of this species has led to much confusion. So, during a long time it was assumed that there were two species, *L. gemmatum* Fr. and *L. perlatum* Pers. According to Massee (J. Roy. Micr. Soc., 1887, p. 710) *L. perlatum* was characterized by the presence of a columella and an umbo, and *L. gemmatum* by the absence of these characters. Oudemans (l. c., 1892) adopted this view too. Morgan (J. Cincinn. Soc. Nat. Hist., vol. 14, 1891, p. 13) distinguished the two species by the colour of the spines, *L. perlatum* having greyish, brown or black spines, *L. gemmatum* white or grey. Hollós and Lloyd noted the identity of these two species, but they both failed to give a clear account of the variability of the species.

Key to the varieties.

The following varieties are based on the structure of the exoperidium.

1a. Big spines either simple and thick, or consisting of a number of thinner ones, which are closely grown together at full length.

2a. With a very distinct reticulate structure, the big spines being regularly surrounded by small spines, and leaving a paler areole when fallen off (which they easily do) (*fig. 9*) . . . . . var. **typicum**

2b. Without a distinct reticulate structure, either since there is no distinct differentiation between big and small spines, or since the small spines are very rudimentary, or since the small spines do not surround the big ones regularly; spines mostly not falling of easily (*fig. 10*) . . var. **bonordeni**

1b. Big spines slender and curved, standing together in little groups (each group mostly consisting of 4—6 spines) and at most grown together only at the base and the top of the spines. Mostly with a distinct reticulate structure (*fig. 11*) var. **nigrescens**

Lycoperdon perlatum Pers. var. **typicum** — *Lycoperdon gemmatum* Fr. var. *perlatum* (Pers.) Fr., Syst. Myc., vol. 3, 1829, p. 37 — for further synonyms see above.

Big spines either simple and thick, or consisting of a number of thinner ones, which are closely grown together at full length; exoperidium with a very distinct reticulate structure, because of the big spines being regularly surrounded by small spines, and leaving a paler areole when they have fallen off (which they easily do) (*fig. 9*); spines straight, white or yellowish brown. Nearly always caespitose.

Specimens examined: Gr.: Groningen (Oranjezon), 1863 (GRO); Gld.: Apeldoorn, 1877, *Oudemans* (GRO); Epe, 1948, *van Kregten* (L); Heelsum, *Buse* (L); Hoge Veluwe, 1948, *van der Hammen* (L); Kotten, 1949, *van Ooststroom* 11387 (L); Nieuw Milligen, 1948, *Hoogland* (coll. Hoogland); Ruurlo, 1948, *Agsteribbe* (L); Wageningen, 1948, *Boetje—van Ruyven* (L); 1948, *Gremmen* (L); Warnsveld, 1892, *Oudemans* (L); Wilp, 1945, 1948, *van Heurn* (L); Utr.: Lage Vuursche, 1917, *van Overeem* a. o. (A); 1948, *Kleyn* (L); Maarn, 1948, *Agsteribbe* (L); Maarsbergen, 1948, *Agsteribbe* (L); Over-Holland, 1948, *Agsteribbe* (L); N. H.: Bergen, 1948, *Heybroek* (L); Bussum, 1915, *Boedijn* (A); 1916, *van Overeem* a. o. (A); Hilversum, 1914, *Toxopeus* (A); 1916, *Boedijn* (A); Huizen, 1948, *Heybroek* (L); Vogelenzang, 1948, *Kleijn* (L); Z. H.: Leiden (Zuidwijk), *Molkenboer* (L); Noordwijk, 1948, *van Ooststroom* 11036 (L); Warmond, 1949, *van Ooststroom* 12454 (L); Wassenaar, 1913, *ten Kate*, monstrum (L); Duinrell, 1948, *Vervoort* (L); 1948, *Maas Geesteranus* 3240 (L); 1948, *Perdeck*, 187 (L); (Meiendel), 1948, *Perdeck*, 159, 178—181 (L); N. B.: Tilburg, 1945, *Liernur* (L); Limb.: Valkenburg, 1900, *Rick* (GRO); Vlodrop, 1948, *Holthuis* (L).

Lycoperdon perlatum Pers. var. **bonordeni** (Mass.) Perdeck nov. comb. — *Lycoperdon hirtum* Bon. in Bot. Zeit., vol. 15, 1857, p. 631 — *Lycoperdon Bonordeni* Mass. in J. Roy. Micr. Soc., 1887, p. 713.

Big spines either simple and thick, or consisting of a number of thinner ones, which are closely grown together at full length; exoperidium without a distinct reticulate structure, either because there is no distinct differentiation between big and small spines, or since the small spines are very rudimentary, or since the small spines do not surround the big ones regularly (*fig. 10*); spines mostly not easily falling off and very variable in form, mostly dark-coloured. Caespitose, in groups or solitary.

Specimens examined: Gr.: Paterswolde, 1832, *van Hall* (U); 1830, *van Hall* (L); Gld.: Apeldoorn, 1915, *van Overeem* (A); Brummen, 1863, *Oudemans* (GRO); Eerbeek, 1942, *Koster* 771 (L); Lunteren, 1944, *Maas Geesteranus* 3048 (L); N. Milligen, 1948, *Hoogland* (coll. Hoogland); Nunspeet, 1898, *Beins* (L); Renkum, 1851, *Buse* (L); Ruurlo, 1948, *Agsteribbe* (L); Utr.: Doorn, 1869, *Oudemans* (GRO, L, U); Leersum, 1948, *Agsteribbe* (L); N. H.: Aerdenhout, *Splitgerber* (L); Bussum, 1916, *van Overeem* a. o. (A); Hilversum, 1915, *van Overeem* a. o. (A); 1914, *Kaiser* (A); Vogelenzang, 1948, *Kleijn* (L); Z. H.; Kijkduin, *de Lint* (L); Leiden, *Molkenboer* (L); *van der Sande Lacoste* (NBV); 1845, *Oudemans* (L); (Zuidwijk), 1843, *van der Sande Lacoste* (L); Wassenaar (Duinrell), 1948, *van Ooststroom* 11058 (L); 1948, *Perdeck* 156, 157, 188 (L); (Kaaphorst), 1948, *Perdeck* 168 (L); N. B.: Breda, 1865, *Oudemans* (GRO); Eindhoven, 1948, *Daams* (L); Limb.: Mechelen, 1949, *Hoogland* (coll. Hoogland).

Remarks:

1. As appears from specimens in his herbarium, Persoon already classed this variety under *L. perlatum* (see e. g. no. HLB 910.258—681, 910.258—682, 910.258—761). There are in his herbarium some more specimens of this variety (no. HLB 910.256—1275) which Persoon called *Lycoperdon obscurum*, but he never published this name. On the label he wrote: "species a *L. perlato* differre videtur".

2. In my opinion it is clear that Bonorden (l. c.) meant this variety with his *L. hirtum*. I cite the most important sentence of his description: "Sie unterscheidet sich aber von *L. gemmatum* dadurch, dasz die Stacheln nicht von kleineren kreisförmig umstellt sind, dasz diese nicht abfallen,

sondern antrocknen und somit keine Areolen hinterlassen etc.". However, the name *L. hirtum* was already used in another sense, so Massee (l. c.) called the species *Lycoperdon bonordeni*. I consider this species as a variety for I found transitions between it and *L. perlatum* var. *typicum* and *L. perlatum* var. *nigrescens*.

3. The specimens called *L. hiemale* by Westendorp (Prodr. Fl. Bat., vol. 2, pars 4, 1866, p. 14) appeared to be this variety, as is also partly the case with the specimens he called (l. c. p. 13) *L. gemmatum* var. *excipuliforme* Scop., *L. gemmatum* var. *perlatum* Pers. and *L. gemmatum* var. *furfuraceum* Fr. Oudemans called this variety mostly *L. gemmatum* var. *perlatum* (specimens in herb. GRO).

Lycoperdon perlatum Pers. var. **nigrescens** Pers., Syn. Fung., 1801, p. 146; Killermann, Krypt. Forsch., vol. 1, 1926, p. 505 — *Lycoperdon nigrescens* (Pers.) Lloyd, Myc. Notes, vol. 2, 1905, p. 212, 229, 338; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 28.

Big spines dark coloured, slender and curved, standing together in little groups, each group consisting mostly of 4—6 spines, and at most grown together only at the base and the top of the spines; exoperidium mostly with a distinct reticulate structure (*fig. 11*). Mostly in groups.

Specimens examined: Fr.: Oranjewoud, 1949, *van Foreest* (L); Dr.: Vledderveen, 1948, *Siebering* (L); Ov.: Diepenveen, 1916, *Vuyck* (L); Gld.: Oosterbeek, 1948, *Gremmen* (L); Renkum, 1848, 1850, *Buse* (L); Wageningen, 1849, *Buse* (L); Wilp, 1945, 1946, *van Heurn* (L); Utr.: Baarn, 1948, *Hueck* (L); Maarsbergen, 1948, *Duin* (L); Oud-Leusden, 1948, *Perdeck*, 150 (L); N. H.: Bussum, 1913, 1916, *van Overeem* a. o. (A); 1915, *Boedijn* (A); Z. H.: Leiden, *Molkenboer* (L); Warmond, 1949 *van Ooststroom* 12471 (L); Wassenaar, *Molkenboer* (L); (Duinrell) 1948, *Maas Geesteranus* 3235 (L); (Raaphorst), 1948, *Maas Geesteranus* 3251 (L); 1948, *Perdeck* 160, 167, 169, 170, 192, 193 (L); 1948, *Leidse Biologen* (L); N. B.: Bergen op Zoom, 1901, *La Fontijn* (GRO); Eindhoven, 1948, *Daams* (L); Limb.: 1900, *Rick* (Maastr.).

Distribution: Europe (Sweden, England, Netherlands, Germany, Austria), N. America.

Remarks:

1. Going by the description which Persoon in 1801 (Syn. Fung. l. c.) gave of his var. *nigrescens* it is not clear that he meant what we now understand by this variety, since he only stated the dark colour of the spines. However, our hesitation turns into certainty when reading his remark in J. de Bot., vol. 2, 1809, p. 21: "La variété de mon Synops. fung. paraît une espèce distincte, parce que les aiguillons sont plus forts et presque point réunis ensemble" (spaced by me, P.). In my opinion, the characters are not sufficiently sharp to make it a distinct species, as was done by Lloyd and T. C. E. Fries.

2. In Persoon's herbarium there is no material under this name. There exists a specimen of this variety under the name *L. nigricans* (no. HLB 910.258—477), to which Persoon added: "var. *perlati*", see Lloyd, Myc. Notes, vol. 2, 1905, p. 212.

3. Judging from the descriptions I suppose that the following species belong to this variety: *L. foetidum* Bon. in Bot. Zeit., vol. 15, 1857, p. 629 and *L. duthei* Bottomley in Bothalia, vol. 4, 1948, p. 555.

4. To this variety also belong the specimens named *L. gemmatum* Batsch. var. *echinatum* Pers. by Westendorp (Prodr. Fl. Bat., vol. 2,

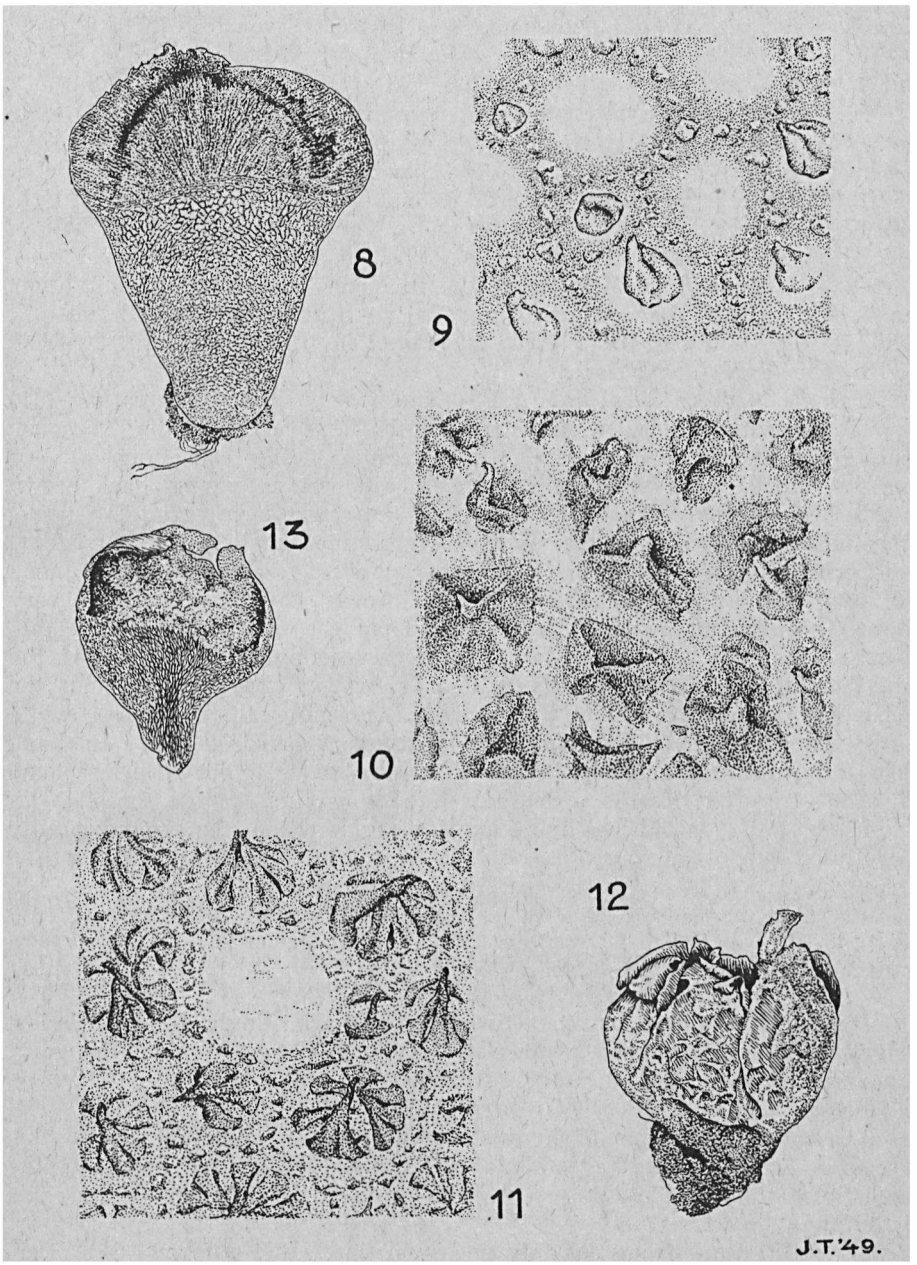

Fig. 8 — *Lycoperdon perlatum* Pers., longitudinal section, nat. size; 9 — *L. perlatum* Pers. var. *typicum*, structure of exoperidium, enlarged; 10 — *L. perlatum* Pers. var. *bonordeni* (Mass.) Perdeck, structure of exoperidium, enlarged; 11 — *L. perlatum* Pers. var. *nigrescens* Pers., structure of exoperidium, enlarged; 12 — *Bovistella radicata* (Dur. et Mont.) Pat., nat. size; 13 — *B. radicata* (Dur. et Mont.) Pat., longitudinal section, nat. size.

pars 4, 1866, p. 13) and Oudemans (Arch. Néerl., vol. 15, 1880, p. 372; Rév. Champ., 1892, p. 463), and *L. molle* Pers. by Westendorp (l. c., p. 14) and *L. echinatum* Pers. by Oudemans (Cat. rais., 1904, p. 38).

10. Lycoperdon pyriforme Pers., Syn. Fung., 1801, p. 148; in J. de Bot., vol. 2, 1809, p. 19; Fries, Syst. Myc., vol. 3, 1829, p. 38; Hollós, Gastr. Ung., 1904, p. 111; Lloyd, Myc. Notes, vol. 2, 1905, p. 212; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 36; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 28; Cunningham in Proc. Linn. Soc. N. S. Wales, vol. 51, 1926, p. 632; Gaster. Austr., 1942, p. 149; Killermann, Krypt. Forsch., vol. 1, 1926, p. 506; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1934, p. 78; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 146 — *Lycoperdon saccatum* Pers., in J. de Bot., vol. 2, 1809, p. 19 (non Vahl, nec Fries).

Fungus 2—5 (6) cm high, 1,5—3 cm wide, height-width ratio $^2/_1$ to $^1/_1$; mostly with a stem, which merges into the head gradually, or sometimes suddenly; sometimes sessile; exoperidium mostly consisting of very small, crowded warts, which are white or yellowish in young, dark brown in adult specimens; these warts are sometimes more mealy-granular, sometimes more spinulose scaly; rarely they are distinct small spines, persistent; endoperidium pale brown sometimes shiny; pore up to about 4 mm in diam., not very regular; gleba olive or umber brown when ripe, with a very distinct regular columella, which is free from the rest of the gleba; subgleba not sharply separated from the gleba, occupying $^5/_7$ to $^3/_7$ of the total height, finely cellular, white or pale brown, always paler than the gleba when ripe; root strongly developed, forming thick ramose, white cords, which connect the specimens of a group; spores 3,4—4,9 μ in diam. globose, smooth or nearly so; threads of capillitium up to 6,3 μ thick, coloured, often granular, ramose; often mixed with hyaline, septate threads.

Habitat: on old logs and stumps, more rarely on the ground, mostly caespitose; Aug. to Nov.

Specimens examined: Gld.: Doetinchem, 1915, *Exc. N.N.V.* (L); Lage Vuursche, 1948, *Kleijn* (L); Middachten, 1936, *Nannenga* (U) 1948, *Schweers* (L); Ubbergen, 1866, *van Hall* (L); Wageningen, *de Lint* (L); Winterswijk, 1918, *ten Houten* (L); N. H.: Bloemendaal, 1915, *Cool* (L); Z. H.: Dordrecht, 1945, 1949, *Kinstra* (L); Limb.: Mechelen, 1949, *van Tooren* (coll. Hoogland); Valkenburg, 1900, *Rick* (Maastr.).

Distribution: Europe (Sweden, Denmark, England, Netherlands, Belgium, France, Germany, Switzerland, Austria, Czechoslowakia, Hungary, Rumania, Bulgaria, Spain, Italy), America, Australia, Asia.

Remarks:

1. In the herbarium of Persoon there exists only one sheet with this species to which a label is added written by Persoon; he noted on the label: "var. umbone nullo aut obsoleto" (no. HLB 910.258—341). This is the type.

2. As appears from the only specimen (no. HLB 910.258—641) Persoon left of his *L. saccatum* Pers. (non Vahl aut Fries), this species is identical with *L. pyriforme*.

3. All specimens called *L. piriforme* Rüpp. by Westendorp and Oudemans appeared to be *L. spadiceum*. Most probably they did not know the real *L. pyriforme*.

11. Lycoperdon spadiceum Pers. in J. de Bot., vol. 2, 1809, p. 18; Hollós, Gastr. Ung., 1904, p. 113; Lloyd, Myc. Notes, vol. 2, 1905, p. 216; Killermann, Krypt. Forsch., vol. 1, 1926, p. 507; Cunningham in Proc. Linn. Soc. N. S. Wales, vol. 51, 1926, p. 635; Gaster. Austr., 1942, p. 151— *Lycoperdon lividum* Pers. in J. de Bot., vol. 2, 1809, p. 18.

Fungus 1,2—5 (9) cm high, 1—4 (6) cm wide, height-width ratio $^2/_1$ to $^3/_4$; sessile or with a more or less distinct stem; exoperidium in young specimens consisting of crowded spinulose granules, which are mostly grey in the upper and white in the under part of the fungus; in older specimens the surface is nearly smooth or finely granular, or mealy; the stem shows often dark brown, warty, small scales; distinct spines always wanting; often with small cracks, sometimes with scattered white granules (lime?); endoperidium yellowish, shiny; pore 1—5 mm in diam., mostly regular, often somewhat mammose; gleba olive or umber brown when ripe, with an irregular, little developed columella, which is not free from the rest of the gleba; subgleba pretty sharply separated from the gleba, without diaphragm, occupying $^7/_{10}$ to $^1/_5$ of the total height, finely cellular, purplish umber-brown when mature; spores 3,5—4,9 μ in diam.; globose, smooth or finely warted; threads of capillitium to 5,6 (7,7) μ thick, coloured, ramose.

Habitat: between moss or grass, mostly in dunes, more rarely in pastures, mostly on sand; often growing together with *Lycoperdon ericetorum* Pers.; solitary or in groups, rarely in small clusters; Aug. to Nov. (Febr.).

Specimens examined: Gr.: Groningen, 1856, *Stratingh* (GRO); Gld.: Nunspeet, 1898, *Beins* (L); Utr.: Blaauwkapel, 1841, *van der Sande Lacoste* (L); Doorn, 1869, *Oudemans* (L, GRO, U, NBV); Lage Vuursche, 1948, *Kleijn* (L); N. H.: Amsterdam, 1948, *Agsteribbe* (L); Bergen, 1948, *Heijbroek* (L); Bloemendaal, 1915 (L); Bussum, 1916, 1917, *van Overeem* a. o. (A); Haarlem, *Splitgerber* (L); 1914, *Cool* (L); Weesp, 1914, *van Overeem* (A); Z. H.: Dordrecht, 1945, 1949, *Kinstra* (L); Katwijk, 1835, *Molkenboer* (L); *Jongmans* (L); 1948, *Maas Geesteranus* 4361, 4362 (L); Loosduinen, 1888, *Destrée* (L); Oegstgeest, 1949, *Koster* 1625 (L); Wassenaar, *Molkenboer* (L); 1846, *Oudemans* (GRO, NBV); (Meyendel), 1948, *Perdeck* 177 (L); (Voorlinden), 1948, *Maas Geesteranus* 4341, 4343 (L); 1948, *Perdeck* 189 (L); Zeel.: Zwake, *van den Bosch* (L); N. B.: Bergen op Zoom, 1900, *La Fontijn* (GRO); Scheldedijken, 1901, *La Fontijn* (GRO).

Distribution: Europe (Denmark, England, Netherlands, Belgium, France, Germany, Austria, Hungary, Russia), Australia.

Remarks:

1. The first two give a clear description of this species was Hollós (1904, l. c.) and he applies to it the name *L. spadiceum*. Now in Persoon's herbarium there is only one sheet on which occurs the name *L. spadiceum* (no. HLB 910.256—1274). On the label, written by Persoon, one reads: "Gallia *Lycoperdon pyriforme* Batsch. Syn. Fung.? — *spadiceum*." The question-mark and " — *spadiceum*" are written in other ink and have apparently been added afterwards. So Persoon at first had taken it to be *L. pyriforme*, but later he began to doubt and thought that it was perhaps *L. spadiceum*. The specimens which are in bad condition are in my opinion *L. pyriforme*. We can only guess from his description and plate in J. de Bot., vol. 2, 1809, p. 18, tab. 1, fig. 5 what Persoon meant with *L. spadiceum*. But these are so little characteristic, that other species could have been meant as well (e. g. *L. ericetorum* Pers.). Now Hollós's

interpretation does not disagree with Persoon's description and plate and since the species is now generally known under this name, I propose to keep this name.

2. I agree with Hollós that *L. lividum* Pers., of which no authentic material exists, very probably is an immature *L. spadiceum*.

3. Judging from the description I think that to this species also belongs what is named *L. molle* Pers. by Trelease (Trans. Wiscons. Acad., vol. 7, 1889, p. 115), Morgan (J. Cincinn. Soc. Nat. Hist., vol. 14, 1891, p. 17), Hollós (Gastr. Ung., 1904, p. 112), Petri (Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 19) and others.

4. Westendorp (Prodr. Fl. Bat., vol. 2, pars 4, 1866, p. 13) and Oudemans (Arch. Néerl., vol. 15, 1880, p. 373; Rév. Champ., 1892, p. 469; Cat. rais., 1904, p. 39) called this species *L. piriforme* Rüpp.

4. BOVISTELLA Morg.

in J. Cincinn. Soc. Nat. Hist., vol. 14, 1892, p. 141.

Differs from *Lycoperdon* and *Calvatia* by the capillitium, which has the same structure as in *Bovista*; differs from *Bovista* by the possession of a subgleba; spores pedicellate; permanently attached to the substratum by a rooting base.

Remarks:

This genus was created by Morgan (l. c. 1892) as a monotypic genus, based on the species now called *Bovistella radicata* (Dur. et Mont.) Pat., which possesses a capillitium like *Bovista* and a subgleba. Lloyd (Myc. Notes, vol. 1, 1901, p. 85) was of the opinion that a sterile base was not a good character to separate it from *Bovista* and proposed to distinguish the two by their habit, *Bovista* being a genus in which the plant at maturity breaks away from the point of attachment, whereas in *Bovistella* the fungus remains attached as is the case in *Lycoperdon*. In a later paper (Myc. Notes, vol. 1, Lyc. Austr., 1905, p. 28) Lloyd emended *Bovistella* by including all species which show the combined characters of possessing a rooting base and having pedicellate spores, and in 1906 (Myc. Notes, vol. 2, p. 277) he goes so far as to include in the genus all species having a rooting base and either pedicellate spores or a capillitium of the *Bovista*-type. T. C. E. Fries (Ark. f. Bot., vol. 17, no. 9, 1921, p. 30) agreed with Lloyd's view of 1906, Cunningham (Proc. Linn. Soc. N. S. Wales, vol. 50, 1925, p. 367—368) with that of 1901. In 1942, however, Cunningham (Gastr. Austr., 1942, p. 142) rejected the genus on the grounds that some species examined by him could be placed under *Bovista* as well as under *Bovistella*, since specimens in the same collection may or may not possess a rooting base. According to him all species of *Bovistella* should be placed in the genus *Bovista*.

In my opinion this is not at all justified. If we take the genus in Morgan's original sense, that is including all species with a subgleba and a capillitium of the *Bovista*-type, there is, as far as I can see, not a single case which causes confusion with *Bovista*. In this sense all species, which Lloyd (l. c. 1906, p. 279) placed under his section "*Bovistella* true" belong to *Bovistella*, whereas his second and fourth section are identical with *Lycoperdon* and his third with *Bovista*.

Key to the species of Bovistella.

1a. Subgleba compact . . . . . 1*. **B. paludosa**
1b. Subgleba cellular . . . . . 2. **B. radicata**

1*. **Bovistella paludosa** (Lév.) Pat. in Lloyd, Myc. Notes, vol. 1, 1902, p. 88; vol. 2, 1906, p. 280; T. C. E. Fries in Bot. Not., 1933, p. 155; Favre in Bull. Soc. Myc. France, vol. 53, 1937, p. 293; Sandberg in Acta Phytogeogr. Suecica, vol. 13, 1940, p. 73 — *Bovista paludosa* Lév. in Ann. Sc. Nat., 3e ser., vol. 5, 1846, p. 163 — *Calvatia paludosa* (Lév.) de Toni in Sacc., Syll. Fung., vol. 7, 1888, p. 106.

This species which grows in swampy places, has not yet been found in the Netherlands. It is known from Sweden, England, Germany, France, Czechoslovakia, Yugoslavia (Montenegro), Italy. (cf. Lloyd, Myc. Notes, vol. 7, 1923, p. 1214).

2. **Bovistella radicata** (Dur. et Mont.) Pat. in Bull. Soc. Myc. France, vol. 15, 1889, p. 55; Hollós in Termész. Füz., vol. 25, 1902, p. 99, 129; Lloyd, Myc. Notes, vol. 2, no. 22, 1906, p. 262, 280, tab. 87; Icon. in Bull. Soc. Myc. France, vol. 42, 1926, Atlas tab. 14; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 151 — *Lycoperdon radicatum* Dur. et Mont. in Durieu, Flore d'Algérie, vol. 1, 1846—'49, p. 383; Montagne, Syll. Crypt., 1856, p. 287 (non W. et C.) — *Mycenastrum ohiense* Ell. et Morg. in J. Myc., vol. 1, 1885, p. 89 — *Bovistella ohiensis* (Ell. et Morg.) Morg. in J. Cincinn. Soc. Nat. Hist., vol. 14, 1892, p. 141; Lloyd, Myc. Notes, vol. 2, no. 23, 1906, p. 279.

Fungus 2—$3^1/_2$ cm high, $2^1/_3$—$3^1/_2$ cm wide (rarely exceeding 8 cm according to Kambly and Lee), height-width ratio from $^2/_3$ to $^1/_1$, sessile or with an indistinct short stem, subglobose or depressed globose; exoperidium consisting of a white, uneven coat, which at maturity changes in more or less separate flat spiny scales with a dark top, and which after having fallen away, leave an indistinct reticulate structure, further down they have a more spiny character, eventually they disappear wholly on the upper part; endoperodium somewhat shiny, light brown; pore at first small, afterwards large, irregularly dehiscing; gleba umber-brown, incoherent, flocculose, without columella, at maturity disappearing, through the aperture; subgleba definitely limited above, occupying $^1/_3$ to $^2/_3$ of the total height, cupshaped, cellular, at maturity umber-brown; spores globose to somewhat ovoid, 4,5—5,2 μ in diam., smooth, with a mostly 5,7—8,0 μ long pedicel; capillitium of the *Bovista*-type, main stem 4,2—5,6 μ thick — *fig. 12, 13.*

Habitat: on sheep tracks in heaths, September.

Specimens examined: Gld.: Otterlose heide, 1915, *de Meyere* (L).

Distribution: Europe (Netherlands, Germany, Spain), Africa (Tunis, Algiers), N. America. Pilát (Bull. Soc. Myc. France, vol. 53, 1937, p. 102) records the species also from Bulgary, but the description he gives makes me doubt, for he does not mention the cellular character of the subgleba.

Remark:

Cool (Lev. Natuur, vol. 20, 1915, p. 104; Meded. Ned. Myc. Ver., vol. 7, 1916, p. 16) records the find of a dubious species, *Bovistella ammophila* (Lév.) Lloyd, in the dunes near Zandvoort.

From the superficial description and the figure I cannot decide which species it really was and, unfortunately, no material has been preserved.

Literature about *Bovistella ammophila:* Léveillé in Ann. Sc. Nat., 3e sér., vol. 9, 1848, p. 129; Lloyd, Myc. Notes, vol. 1, 1902, p. 88; vol. 2, 1906, p. 262, 281; vol. 7, 1923, p. 1214.

5. BOVISTA Pers.

Syn. Fung., 1801, p. 136.

Subglobose, soon loosening from the substratum; exoperidium membranaceous, nearly smooth, flaking off at maturity; endoperidium thin, opening by a mostly regular pore; gleba without columella; subgleba wanting; capillitium of little units, each consisting of a thick short main stem and slender ramose branches with tapering pointed ends; spores globose or ovoid, smooth or finely warted, mostly with a persistent pedicel.

Key to the species of Bovista.

1a. Spores 6—10 μ in diam. . . . . **2. B. macrospora**
1b. Spores 4—6 μ in diam.
  2a. Spores without a pedicel or with a very short one (about 1 μ long) **1*. B. pila**
  2b. Spores with a long pedicel (4.2—13.3 μ long).
    3a. Pedicels of the spores strongly curved, nearly circular . . **3. B. hungarica**
    3b. Pedicels of the spores straight or slightly curved.
      4a. Fungus 1.5—4 cm in diam.; endoperidium dull, lead-coloured, rarely brownish; mature gleba not purplish; spores mostly ovoid, with a 8.4—13.3 μ long pedicel . . . . . **5. B. plumbea**
      4b. Fungus 3—5 cm in diam.; endoperidium somewhat shiny, dark brown, often purplish; mature gleba purplish; spores mostly globose, with a 4.2—8.0 μ long pedicel . . . . . **4. B. nigrescens**

1*. Bovista pila Berk. et Curt. in Grevillea, vol. 2, 1873, p. 49; Lloyd, Myc. Notes, vol. 1, 1902, p. 116; Hollós, Gastr. Ung., 1904, p. 122; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 150.

Not found in the Netherlands, known from N. America and Europe (Hungary, one specimen, cf. Hollós, l. c.).

2. Bovista macrospora Perdeck, nov. spec.

Fungus 1,8 cm alta, 2,3 cm lata, subglobosa, subdepressa, peridium ubique lacunosa (in sicco), exoperidium flavo-brunneum, endoperidium cinereum, gleba flavo-olivacea, sporae 6,3—9,8 μ diam., globosae vel subglobosae, laeves, pedicellis 4,2—10,5 μ longis, apicem versus attenuatis; rami principales capillitii 14—25 μ crassi, pariete subtenue.

Fungus 1,8 cm high, 2,3 cm wide, globose, somewhat depressed; peridium lacunose; exoperidium yellow-brown; endoperidium greyish; pore not yet present; gleba yellowish-olivaceous; spores 6,3—9,8 μ in diam., globose or subglobose, smooth, with an 4,2—10,5 μ long, attenuated pedicel; capillitium of the *Bovista*-type, main stem 14—25 μ thick, wall thinnish.

Type specimen: Z. H.: near Dordrecht ("de Staart"), 30 Nov. 1945, *Kinstra* (L); young specimen.

Remark:

Differs from all known *Bovista* species by the large spores. Related to *Bovista plumbea*, but differs also by the relatively shorter pedicels of the spores.

3. **Bovista hungarica** Holl. in Math. és Termész. Ertesito, vol. 19, 1901, p. 512; Gastr. Ung., 1904, p. 122; Killermann, Krypt. Forsch., vol. 1, 1926, p. 508; Feurig in Zs. f. Pilzkunde, vol. 12 (N. F.), 1928, p. 119.

Fungus 2,1—4,5 cm in diam., subglobose; exoperidium practically wanting in the specimens examined (Hollós does not give a description of it); endoperidium smooth, mostly somewhat silvery shiny and dirty grey, with darker, brown or purplish stains; pore irregularly dihiscent; gleba umber-brown, usually somewhat purplish; spores globose or subglobose, 4,9—5,6 μ diam., smooth or very finely warted, with a fairly long, very much curved (nearly circular) pedicel; capillitium with a 10—20 μ thick main stem.

Habitat: vegetable garden, according to Hollós on stubble-fields, Nov.—Jan., May, July; sometimes some specimens connected at the base.

Specimens examined: Gld.: Herwen, 1914, *Wakker* (L); Wilp, 1945, 1946, 1947, 1949, *van Heurn* (L).

Distribution: Europe (Hungary, Germany, Netherlands), very rare.

Remark:

The Dutch specimens fully agree with Hollós's description and figures. Very well characterised by the strongly curved pedicels of the spores.

4. **Bovista nigrescens** Pers., Syn. Fung., 1801, p. 136; in J. de Bot., vol. 2, 1809, p. 24; Fries, Syst. Myc., vol. 3, 1829, p. 23; Westendorp, Prodr. Fl. Bat., vol. 2, pars 4, 1866, p. 12; Oudemans, Arch. Néerl., vol. 15, 1880, p. 369; Rév. Champ., 1892, p. 471; Cat. rais., 1904, p. 40; Lloyd, Myc. Notes, vol. 1, 1902, p. 117; Hollós, Gastr. Ung., 1904, p. 124; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 61; Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 32; Killermann, Krypt. Forsch., vol. 1, 1926, p. 508; Alexandri in Mem. Sect. Stiint. Acad. Rom. ser. 3, vol. 9, 1934, p. 49 — *Lycoperdon nigrescens* (Pers.) Vitt., Mon. Lyc., 1842, p. 32; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 176.

Fungus 3,2—5 cm in diam., mostly subglobose, sometimes kidney-shaped; exoperidium white or yellowish, smooth or somewhat rough, soon flaking off; endoperidium umber-brown or black-brown, rarely more yellow-brown, usually purplish and maculate, shiny, often with sharp transverse folds; pore 0,7—3,0 cm in diam., irregular; gleba young umber-brown, dark purplish brown when mature; spores 4,9—6,3 μ in diam., mostly globose, sometimes slightly ovoid, mostly finely, but distinctly warted (1000 ×), with a 4,2—8,0 μ long, straight or slightly curved pedicel; capillitium with a 12—20 μ thick main stem.

Habitat: grassy fields, March to October.

Specimens examined: Fr.: Oude Mirdummer Klif, 1928, *Zuiderzeeonderzoek* (L); Gld.: Ede, 1916, *de Meyere* (L); Hummelo, 1915, *de Meyere* (L); Wilp, 1946, 1947, 1948, 1949, *van Heurn* (L); N. H.: Beverwijk, 1915, *Vorstman* and *van Overeem* (A); Zeel.: Domburg, 1877, *Oudemans* (L); Walcheren, *van den Bosch* (L).

Distribution: Europe (Sweden, Denmark, England, Netherlands, Belgium, Germany, Austria, Russia, Czechoslovakia, Hungary, Rumania, Yugoslavia, Bulgaria, Italy).

Remarks:

1. Between *B. nigrescens* and *B. plumbea* I found the following differences:

		B. nigrescens	*B. plumbea*
1.	size	3—5 cm	1,4—4 cm
2.	colour of endoperidium	mostly dark brown, maculate	mostly grey, uniform
3.	surface of endoperidium	shiny	dull
4.	pore	0,7—3 cm in diam., irregular	0,3—1,0 cm in diam., regular
5.	colour of mature gleba	purplish	olive or umber-brown
6.	shape of spores	mostly globose	mostly ovoid
7.	sculpture of spores	distinctly finely verrucose	nearly smooth
8.	length of pedicel of spores	4,2—8,0 μ	8,4—13,3 μ

All these differences are mentioned in literature, except the seventh. Some of them seem to be inconstant. According to Vittadini, Morgan, Hollós and Lloyd (l. c.) the gleba of *B. plumbea* ultimately turns purplish. The length of the spore-pedicels which Lloyd and T. C. E. Fries consider to be a good character, is of no importance according to Hollós, Alexandri and Petri. Sometimes, the endoperidium of *B. plumbea* is not grey, but brown. This holds good for the type-specimen of this species (see under *B. plumbea*, remark 2). The other differences mentioned may all be observed in the types of these two species. Petri gives a difference in the branching of the capillitium threads, which I could not affirm. Another characteristic feature seems to be that, at least for the Netherlands, *B. nigrescens* has never been found in the winter months.

2. Killermann calls the small specimens forma *minor*, which seems to be superfluous.

3. The type of this species indicated by Lloyd is no. HLB 910.262—752 in the herb. Persoon.

5. **Bovista plumbea** Pers., Syn. Fung., 1801, p. 137; in J. de Bot., vol. 2, 1809, p. 24; Fries, Syst. Myc., vol. 3, 1829, p. 24; Westendorp, Prodr. Fl. Bat., vol. 2, pars 4, 1866, p. 13; Oudemans, Arch. Néerl., vol. 15, 1880, p. 369; Rév. Champ., 1892, p. 471; Cat. rais., 1904, p. 40; Lloyd, Myc. Notes, vol. 1, 1902, p. 115; Hollós, Gastr. Ung., 1904, p. 122; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 62; Killermann, Krypt. Forsch., vol. 1, 1926, p. 508; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1934, p. 48; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 15 — *Bovista tunicata* Fries, Syst. Myc., vol. 3, 1829, p. 25 — *Lycoperdon plumbeum* Vitt., Descr. Funghi Manger., 1835, p. 257; Mon. Lyc., 1842, p. 30; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 174.

Fungus 1,7—4,0 cm in diam., subglobose; exoperidium dirty white or yellowish, nearly smooth or finely granular, flaking off at maturity; endoperidium light or dark lead-coloured, sometimes brown, dull, lightbrown at the margin of the pore; pore 3—10 mm in diam., mostly regular; gleba olive or umber-brown; spores 4,9—5,6 μ long, 4,2—4,9 μ broad, mostly slightly ovoid, occasionally globose, smooth or very indistinctly warty, with 8,4—13,3 μ long pedicels, which are straight or slightly curved; main stem of capillitium 10—17,5 μ thick.

Habitat: on grassy places, dunes, heath, August to April.

Specimens examined: Fr.: Workum, 1928, *Zuiderzeeonderzoek* (L); Ov.: Beuningen-Achterheide, 1948, *van Steenis* (L); Gld.: Beek, *Gevers Deynoot* (NBV); Ede, 1915, *de Meyere* (L); Epe, 1948, *van Kregten* (L); Putten, 1884, *Oudemans* (L); Weurt, 1847, *Abeleven* (L); Winterswijk, 1916, *van Luyk* (A); Utr.: Doorn, 1869, *Oudemans* (L, GRO, U); N. H.: Bussum, 1917, *van Overeem* a. o. (A); Crailoo, 1916, *Boedijn* (A); Huizen, 1948, *Heybroek* (L); Wieringen, 1856, *van der Sande Lacoste* (L); Z. H.: Den Briel, 1915, *Goethart* (L); Dordrecht, 1949, *Kinstra* (L); 's Gravenhage, 1948, *Perdeck* 164 (L); Koudekerk, 1943, *Fierêt* (L); Kijkduin, *de Lint* (L); Leiden, *Dozy* and *Molkenboer* (L); Zeel.: Walcheren, 1877, *Oudemans* (L); N. B.: Bergen op Zoom, 1900, 1901, *La Fontijn* (GRO).

Distribution: Europe (Sweden, Denmark, England, Netherlands, France, Germany, Russia, Czechoslovakia, Hungary, Rumania, Yugoslavia, Bulgaria, Italy), N. America, Asia.

Remarks:

1. For differences from *B. nigrescens* see under that species (remark 1), where the occurrence of a purplish gleba of *B. plumbea* has already been mentioned.

2. I propose to consider no. HLB 910.262—767 in the herb. Persoon, the type specimen, for of the other sheets, on whose labels the name *plumbea* has been written by Persoon, one (no. HLB 910.262—758) shows specimens which exclusively are *B. nigrescens*, whereas on the other no. HLB 910.262—769) part of the specimens belong to that species. The type specimen has a dark brown endoperidium, which is a rare condition in this species.

3. Specimens with a brown endoperidium have been described as distinct species (*B. fulva* Mass., according to Lloyd, Myc. Notes, l. c., p. 116; *B. brunnea* Berk., according to Lloyd, Myc. Notes, vol. 1, Lyc. Austr., 1905, p. 24; vol. 2, 1906, p. 263). I agree with Lloyd that this difference in colour is not sufficient to distinguish a separate species. As mentioned above, Persoon also called a brown specimen *B. plumbea* (the type specimen).

4. The ovoid form of the spores seems to vary considerably. (cf. Lloyd l. c., vol. 1, p. 115). Probably *B. ovalispora* Cke. et Mass. should be considered synonymous.

5. According to Lloyd (Myc. Notes, vol. 1, 1904, p. 171) who examined the type-specimen, *B. tunicata* Fr. is identical with *B. plumbea*.

6. Hollós (in Termész. Füz., vol. 25, 1902, p. 100, 130; Gastr. Ung., 1904, p. 125) describes a species, called *B. tomentosa* (Vitt.) de Toni, which is distinguished from *B. plumbea* by the chestnut-brown endoperidium and the distinctly warted spores (already at 175 ×), from *B. nigrescens* by the small size (0,8—1,5 cm in diam.), the regular pore and the ovoid spores with a 12—18 μ long pedicel and from both by the tomentose exoperidium and the small spores (4—5 μ in diam.). Hollós states that it may easily be distinguished from both *B. plumbea* and *B. nigrescens* by the distinctly warted spores, but this cannot be maintained, since I found distinctly warted spores in *B. nigrescens* as well (type-specimen!). According to Hollós, *Bovistella dealbata* Lloyd (Myc. Notes, vol. 1, 1902, p. 86; vol. 2, 1906, p. 284) is identical to *B. tomentosa* as is *Bovista minor* Morg. (J. Cincinn. Soc. Nat. Hist., vol. 14, 1892, p. 147). According to Lloyd who examined the type-specimen *B. tomentosa* is a good species (Myc. Notes, vol. 2, 1908, p. 392; vol. 7, 1923, p. 1222). Petri

(Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 63, 64) distinguishes the species also by its sparsely branched capillitium, which according to him has very thick walls, so that the lumen is nearly absent. He found the spores of Vittadini's type to be smooth and doubted whether Hollós's interpretation was correct.

The species is recorded from Europe (Germany, Hungary, Tirol, Italy) and N. America.

6*. MYCENASTRUM Desv.

in Ann. Sc. Nat. 2e sér., vol. 17, 1842, p. 143.

1*. **Mycenastrum corium** (Guers.) Desv. in Ann. Sc. Nat., 2e sér., vol. 17, 1842, p. 147; Hollós in Termész. Füz., vol. 25, 1902, p. 103, 132; Gastr. Ung., 1904, p. 126; Lloyd, Myc. Notes, vol. 1, 1902, p. 119; vol. 1, Lyc. Austr., 1905, p. 24; vol. 2, 1906, p. 290; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 34; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1934, p. 51; Bottomley in Bothalia, vol. 4, 1948, p. 582.

Distribution: Europe (Sweden, Germany, Russia, France, Czechoslovakia, Rumania, Hungary, Yugoslavia, Italy), S. Africa, N. America, Australia, Asia. Not yet found in the Netherlands.