INTRODUCTION

The Hydnaceae is one of the families of Hymenomycetes, erected by Fries in 1874. It is a small family and there are about 300 species (fide Ainsworth, 1961) generally included under it. In Hymenomycetes, it belongs to the order Aphyllorhales and systematically comes in between Thelephoraceae and Polyporaceae. The hydnoid forms vary from resupinate to effused-reflexed to pileate and distinctly stipitate type of fruit bodies with their hymenial surface becoming distinctly spiny, toothed or warted. Fries and some other early workers also included Tremellodon under Hydnaceae because of its toothed hymenial surface. However, later workers
have limited the family to the hydnoid Homobasidiomycetes containing the species with one celled basidia, thereby excluding *Tremellodon* which has toothed hymenophore but with cruciately divided basidia.

The members of *Hydnaceae* might have been noticed by man since time immemorial but the earliest authentic record goes as far back as 1719, when Dilleneus in his 'Catalogus Plantarum sponte circa Gissam nascentium' described and illustrated a plant named *Erinaceus*, the first genus of *Hydnaceae*. Linnaeus (1735) in his 'Systema Naturae' proposed the name *Hydra* as a substitute for *Erinaceus* Dill. In his later publication 'Species Plantarum', 1753, he introduced the generic name *Hydnum* for his *Hydra*.

Persoon was the first author to study this group extensively. In his famous work 'Synopsis Methodica Fungorum', 1801, he described 38 hydnoid species under two genera, *Sistotrema* and *Hydnum*. Both these genera were further divided into sections as follows:

1. a) *Sistotrema*: Hymenium primo porosum demum in dentes compressos lacerum.
   b) *Xyloodon* effusum, resupinatum.

2. a) *Hydnum*: aculei integri, teretes (pileus manifestus).
   b) *Odontia* effusa, resupinata.
   c) *Hericium* elongatum, ramosum.

Albertini and Schweintz (1805) divided the genus *Hydnum* on similar lines on which Persoon (1801) had done.
Fries (1821) erected the class Hymenomycetes and his famous work 'Systema Mycologicum', 1821, has been accepted as the starting point of Botanical Nomenclature for Hymenomycetes. He divided his class Hymenomycetes into 4 orders. The fourth order Hymenini, which mostly included the present day Hymenomycetes, was further divided into two suborders, namely,
i) Clavati, which included genera of Clavariaceae and some Ascomycetes and ii) Pileati, which included the genera Thelophora, Polyporus, Asarius and Hydnium. All the hydnoid fungi were described under Hydnium which was further divided into 5 tribes. Following is Fries' own summary of classification of Hydnium into various tribes:


II. PLEUROPUS. Stipes simplex, subhorizontalis.
   Pileus dimidiatus l. excentricus.
   Carnosi, lignatiles.

III. MERISHA. Pilei cum stipite confusi, obliterati; ramosissimi l, in truncum crassum abeuntes.
   Carnosa, lignatilia.

IV. APUS. Pileus sessilis, lateralis. Lignatiles.

V. RESUPINATUS. Pileus resupinatus, effusus.
   Lignatiles.

Gray (1821), a contemporary of Fries, erected
a number of new genera under Hydnaceae, namely, 
Auriscalpium, Dentinum, Steccerinum. He, however, 
removed Sistotrema and Xylodon from the Hydnaceae 
because of their poroid nature and grouped them along 
with Jerrema under Sistotremideae. He also validated 
the generic name Hericium which was earlier proposed 
by Persoon (1794).

Fries (1825-74), as a result of his more thorough 
study, improved upon his earlier classification and 
mainly on the basis of the configuration of the 
hymenial surface, he segregated 7 genera from his 
earlier Hydnaceae, namely, Hydnaceae, Hericium, Irpex, Radulum, 
Grandinioidea, Odontia and Kneiffia. In addition to 
these, he added up more genera which he had himself 
determined, viz., Fistulinia, Phlebia, Sistotrema, 
Nucronella and the genus Tremellophthora earlier described 
by Persoon. Thus, in 1874, he included 12 genera under 
his 'Hydnaceae'.

Quélet (1876-83), the French mycologist, was the 
first man to improve upon the Fries’ system and to 
introduce the element of naturalism in the classification 
of Hydnaceae. For this, he used microscopic characters 
in addition to macroscopic ones. Quélet (in Cooke & 
Quélet, 1878) recognised 10 out of the 12 genera 
earlier included by Fries under the family Hydnaceae and 
excluded Phlebia and Fistulinia. However, he made 
important changes in the genus Hydnaceae L. ex Fr., a much
heterogenous group. He divided this genus into 5 subgenera (which are now accepted by most of the mycologists as genera) on the basis of texture and external morphology, viz., Hydnum, Sarcodon, Calodon, Pleurodon and Dryodon. In 1886, Quélet replaced his earlier name 'Hydnei' by Erinacei. In the same year, he introduced, for the first time, the microscopic characters such as colour, shape and ornamentation of spores in the classification of Hydnaceae. The use of such microscopic characters, though did not change Quélet's earlier classification of Hydnaceae, made the generic limits more exact. He removed Irpex (which was earlier included by him under 'Hydnei') to Polyporaceae. In 1888, Quélet widened the limits of his family 'Erinacei' and even included the genus Thelephora under it.

Karsten (1879-89) gave importance to the internal structure and hymenium of fruit body and tried to split the hydnoid fungi into more natural and homogenous groups and thus proposed as many as 11 new genera under Hydnaceae. In 1879, he transferred the genera Irpex, Sistotrema and Phellia to Polyporaceae, which were included under Hydnaceae by some earlier workers. He, in 1881, further divided the family Hydnaceae into two subfamilies, namely, 1) Hydneae with spiny hymenial surface and  ii) Grandiniae with warted hymenial surface. In the same year, Karsten also
raised to the generic rank and validated some of
the subgenera earlier proposed by Quélet (1878).
Thus, he set aside his own genera *Hydnellum*, *Auris-
calpium* and *Priesites*, which became later synonyms
of *Calodon*, *Pleurodon* and *Dryodon* of Quélet, respectively,
in recognition of Quélet's priority. In 1889, Karsten
recognised in all 17 genera, out of which many are to
his credit, under the family Hydnaceae. These are:
*Gargodon* Qué. ex Karst., *Tyrodon* Karst., *Calodon* Qué. 
ex Karst., *Phellodon* Karst., *Acia* Karst., *Hydnus* Qué.,
*Climecodon* Karst., *Pleurodon* Qué. ex Karst., *Selerodon*
Karst., *Creolophus* Karst., *Dryodon* Qué. ex Karst.,
*Radulum* Fr., *Grandinia* Fr., *Kneiffia* Fr., *Kneiffiella*
Karst., *Odontia* Fr., and *Mugronella* Fr. He did not
include the genera *Tremellodon*, which belongs to
Heterobasidiomycetes, and *Fistulina* (a polyploid genus
which was also dropped by Quélet, 1878) earlier included
by some authors under this family.

Saccardo (1888), in his 'Sylloge Fungorum',
compiled large number of species (over 400) from all
over the world under 14 genera of Hydnaceae. He was
conservative in his approach and followed all Friesian
genera, practically without any change except that he
did not include *Fistulina* Bull. ex Fr., which he removed
from Hydnaceae to Polyporaceae. Thus, he did not accept
the subgenera and genera independently proposed by
Quélet and Karsten. However, he included the genera
Caldesiella Sacc., Grammothele Berk. & Curt. and Lopharia Kalchbr. & M.Ow. in Hydnaceae.

Schroeter (1869) introduced two new genera, namely, Phaeodon and Amaurodon and three subgenera Microdon, Hypodon and Hydnopsis. He was also much conservative in his approach when he reduced many genera of Quelet and Karsten to the rank of subgenera under Hydnum and Phaeodon.

Patouillard (1887-1900) will be remembered as the first critic of Frisian system of classification of Aphyllophorales. He was the first author to record microscopical observations beyond spores in Aphyllophorales. He published as many as 240 papers in his lifetime. His important works are, 'Hymenomycetes d'Europe', 1887, and 'Essai Taxonomique', 1900, in which he gave his new system of classification of Aphyllophorales. He divided 'Aphyllophorace' (=order Aphyllophorales) into two main categories, namely, 1) tribu des Glavaries (with more or less amphigenous hymenium) and 11) tribu des Porohyndes (with inferior hymenium). Tribu des Porohyndes was further divided into four 'sous-tribu', namely, Cyphelles, Odonties, Pores and Hyndes. Members of Hydnaceae fell under the sous-tribu Odonties and sous-tribu Hyndes. An original summary of his classification of 'Famille de Aphyllophorales' (=order Aphyllophorales) is given below:

1. Tribu des Glavaries
   série des Thelephores
   série des Clavaries
   série des Physalacries
2. Tribu des Porophyènes
   1) sous-tribu: Cyphelles
   2) sous-tribu: Odonties
       série des Odonties
       série des Corticiences
       série des Stereums
   3) sous-tribu Pores
      Groupe: Les Polypores Vrais
             série des Polypores
             série des Leucopores
             série des Leptopores
      Groupe: Les Fomes
             série des Tramates
             série des Igniaires
             série des Placodes
      Groupe: Les Merules
      Groupe: Les Fistulines
   4) sous-tribu Hydnes
      série des Mucronelles
      série des Hydnes
      série des Echinodonties
      série des Phylacteres
      série des Astérostromes

Genera which pertain to Hydnaceae

Odontia and Grammothele
Grandinia, Acia, Kajulum
and Phaeoradulum.

Patouillard’s system of classification was a complex one and, perhaps, due to this fact, remained unnoticed for a long time till the publication of Bourdot and Galzin’s book ‘Hymenomycetes de France’, 1928, in which they followed his system.

Banker (1901-29) was a pioneer worker who devoted full attention to the study of Hydnaceae in North America. In 1902, in his publication ‘A historical review of the proposed genera of Hydnaceae’, he reviewed various
existing genera and introduced a new generic name Etherodon to replace Odontia Fr., which is preoccupied by Odontia Pers. according to him. In his monograph 'Revision of the North American Hydnaceae', 1906, he made a critical study of North American Hydnaceae, treated under 10 genera (Mostly pileate), Hydnium L. (inclusive of Sistotrema Pers.), Hericium Pers., Stecherinum Gray (inclusive of genera Climacodon, Creolophus, Gloiodon and Solerodon of Karsten), Echinodontium Ell. & Ev., Sarcodon Quel. ex Karst., Leaia Banker, Auriscalpium Gray, Hydnellum Karst., Phellodon Karst. and Grandinoides Banker. In his later publications (1910-14), he validated Manina Scop. and used it in place of Hericium Pers. which was accepted by him in 1906. He also recognised the genera Creolophus Karst., Climacodon Karst. and Gloiodon Karst., which he earlier had treated as synonyms of Stecherinum Gray. Banker contributed a lot towards the study of pileate Hydnums in North America, but unfortunately could not extend his research much into resupinate forms.


Bourdot & Galzin (1928), in their classic work, 'Hymenomycetes de France', followed Patouillard in the
distribution of hydnoid genera amongst various tribes and subtribes. They stressed the importance of such characters as amyloid of spore wall, shape of the basidium, consistancy of trama, nature of hyphae, presence of cystidia and other modified structures in the basidiocarps. They recognised 10 genera under 'Hydnaceae' which are: Hydnum L. ex Fr., Acia Karst., Mycoleptodon Pat., Pleurodon Quel., Dryodon Quel., Radulum Fr., Grandinia Fr., Odontia Fr., Sistotrema Pers. and Micronella Fr. Like Patouillard, they also treated the genera Caldesiella, Calodon and Sarcodon under Phylostictaceae, on the basis of their coloured tuberculate spores and dark trama.

Cejp (1930) made a monographic study of Hydnaceae of Czechoslovakia and described 54 species. Like Bourdot & Galzin, he also followed Patouillard's system of classification. He conceived Hydnaceae with hyaline spores and thus excluded, like Bourdot & Galzin, the genera Caldon, Sarcodon and Caldesiella, which have coloured spores, from the family Hydnaceae. He further divided the genus Radulum into two subgenera, namely,
i) Furadulum (Hymenium without 'paraphyses') and
ii) Paraphysotricha (Hymenium with elongate 'paraphyses').
His list of genera included under Hydnaceae is the same as of Bourdot & Galzin (first 1914 and then 1928) with the change that he did not include Sistotrema and included additional genera Hynochaste Bres., Asterodon Pat.,
Lopharia Kalchbr. & M. Ow. and Hericium Pers.

Donk (1931, 33) made a revision of the Aphyllophorales of Netherlands and essentially followed Patouillard's system of classification. He proposed the generic name Mycoacia to replace Agia Karst., which happens to be a later homonym of Agia Schreb. of Rosaceae.

Miller (1933-35) gave a comprehensive account of Hydnaceae of Iowa through a series of papers. He discussed at length the various commonly accepted genera and proposed a new genus Oxydontia distinguished from Odontia by the absence of cystidia and from Grandinia in having longer and distinct spines. He conceived Hydnaceae as comprised of members with distinct spines, teeth or warts not originating from the breaking up of the pores or folds and thus excluded the genera Irpex, Sistotrema, Hydonchaete, Echinodontium and Phlebia from this family. The 16 genera which he recognised for Hydnaceae are: Galeniella, Asterodon, Grandinia, Odontia, Oxydontia, Radulum, Mycoronella, Gloiodon, Stroecherinum, Auriscalpium, Hericium, Dentinum, Hydnodon, Hydnum, Galodon and Grammotheca. Miller & Boyle (1943) followed the generic concepts of Miller (1933a) except that they emended Mycoacia Donk so as to include all species of the genus Oxydontia Miller which they did not recognise.

Brown (1935) made extensive taxonomic and cultural
studies of some species of *Odontia*. He made two sweeping changes by merging genera, *Odontia*, *Mycocesia*, *Grandinia*, *Radium* and *Kneiffia* under one genus *Odontia* Fr. *emend.* Brown.

Coker & Beers (1951) made a monographic study of the stipitate Hydnaceae of Eastern United States. They followed the generic concepts of Banker (1906). These authors described 60 species and introduced one new genus *Bankera*, which is closely allied to *Phelodod Karst.*, but differs by its fleshy and brittle texture.

Ragab (1953) emphasized the importance of hyphal system in segregating the genera of Hydnaceae. He followed Miller's list of genera of 1933 with some changes. He removed *Caldeziella* to Thelephoraceae and replaced *Calodon Quel.* with *Hydnellum Karst.* after emending the latter to include the species of *Phelodod Karst.* as well.

Maas Geesteanus (1956-59) has made rich contributions towards the knowledge of stipitate Hydnaceae. He has published a number of papers on this group under different series, *viz.*, 'The stipitate Hydnaceae of the Netherlands' I-IV, 'Notes on Hydnaceae' I-VIII and 'Hyphal structures in Hydnaceae' I-IV, in which he gave detailed account of hyphal structures in all the known pileate hydnoid genera. He erected two new genera, namely, *Mycorrhaphium* (1962) and *Stegiagatha* (1966a) both related to *Steccherinum Gray*. In 1963a, he erected a
new family Auriscalpiaceae containing two hydnoid genera, *Auriscalpium* Gray (type) and *Gloeodon* Karst. and one agaricioid genus *Lentinellus* Karst. All the three genera have in common, the dimitic hyphal system, hairy external surface, amyloid spores and gloeocystidia.


The modern trend to regroup the species under more natural genera and families of Aphyllophorales, which was initiated by Patouillard (1900) and followed by Bourdot & Galzin (1923) and Donk (1931, 33) got well established by the works of Eriksson (1958), Christiansen (1960) and Donk (1961-64). Eriksson (1958) stressed the importance of natural grouping of species and proposed
as many as 6 new genera for resupinate Aphylllophorales. Under Hyphodontia, one of these 6 genera, which pertains to Hydnaceous fungi, he included species both with smooth as well as toothed hymenial surface but having similar internal structure and spores. Christiansen (1960) made a comprehensive study of resupinate fungi of Denmark. His work 'The Danish resupinate Fungi-II' is most important, as being also a recent monograph in which the newer classification of resupinate Aphylllophorales based on the internal structure, has been followed. He has followed the newer generic concepts, started earlier by Donk and Erikkson. He treats the resupinate Aphylllophorales under 7 families, namely, Corticiaceae, Hymenochaetaceae, Thelephoraceae, Coniophoraceae, Clavariaceae, Hydnaceae and Polyporaceae. The majority of the resupinate Hydnums come under Corticiaceae and are treated in 9 genera, 3 purely hydnoid (Daeryobolus, Odontia and Hyphocagia) and 5 (Sistotrema, Cristella, Phlebia, Hyphoderma and Hyphodontia) containing hydnaceous as well as thelephoraceous species. These species of two hydnoid genera, Radulum and Grandinia, which could not be transferred to a suitable genus, along with such species of Peniophora, are dumped under Corticium Fr. which he uses as an artificial genus. Other resupinate hydnums, which do not fall under Corticiaceae, were treated under other families as follows:

Clavariaceae
Kavinia
Thelephoraceae  
Caldesiella

Hydnaceae  
Steccherinum (only resupinate species)

Donk (1961) erected four new families out of which three pertain to hydnoid fungi. He erected Echinodontiaceae based on single genus *Echinodontium* Ell. & Ry., and Bankeraceae with two hydnoid genera, i.e., Bankera and Phellodon. The third family, Jomphaceae included the two hydnoid genera, Kavinia Pil. and Beenakia Reid along with clavarioid genus Ramearia (Fr.) Bon. and dantharelloid genus *Domphus* Pers. ex Gray. In 1962, Donk segregated the resupinate species of *Hericium* under a separate genus *Dentipellis*. In 1964, he published his 'Conspicuitus of families of Aphyllophorales' in which he revolutionised the classification of the order, radically deviating from the Friesian concept. He erected the family Hericiaceae with four hydnoid genera *Hericium* Pers. ex Gray, Creolophus Karst., Stecchericium Reid and *Dentipellis* Donk. He distributed the genera traditionally treated under Hydnaceae amongst as many as 13 families of Aphyllophorales as follows:

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<tr>
<th>Sr. No.</th>
<th>Family</th>
<th>Genera which pertain to Hydnaceae</th>
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<tbody>
<tr>
<td>1.</td>
<td>Hydnaceae</td>
<td><em>Hydnium</em> L. ex Fr. (s.str.)</td>
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<tr>
<td>2.</td>
<td>Auriscalpiaceae</td>
<td><em>Auriscalpium</em> and <em>Gloiodon</em></td>
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<td>3.</td>
<td>Bankeraceae</td>
<td><em>Bankera</em> and <em>Phellodon</em></td>
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<td>4.</td>
<td>Clavariaceae</td>
<td><em>Nugronella</em></td>
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5. Coniophoraceae  
   
6. Corticiaceae  
   Cristella spp., Hyphoderma spp., Daeroybolus,  
   Hyphodontia spp., Mycogacia, Odontia Fr. (residual genus  
   exclusive of type but inclusive of 'Grandinia' spp.),  
   Sarcodontia and Sistotrema spp.  

7. Echinodontiaceae  
   Echinodontium  

8. Gomphaceae  
   Kavinia, Beenskia  

9. Mericiaceae  
   Dentipellis, Stecherocicum  
   Creolophs and Meridium  

10. Hymenochaetaceae  
    Asterodon, Hydnochaeta  

11. Polyporaceae  
    Irpe  

12. Tremellaceae  
    Pseudohydnm Karst.  
    (Tremelodium (Fers.) Fr.)  

13. Thelephoraceae  
    Caldestiella, Sarcodon and  
    Hydnum  

14. Ascomycetes  
    Radulum  

Thus, he treated Hydnaceae in a strongly reduced  
sense and included only one genus, Hydnum L. ex Fr. (s.str.)  
under it. The remaining hydroid genera, namely,  
Nipoleptodonoides Nikol., Donkia Fil., Climacodon Karst.,  
Nipoorhaphium Maas G., and Stecherocicum Gray and many  
incompletely known species of Hydnum L. ex Fr. (s.lato)  
were listed under the appendix 'Residual Hydnaceae  
exclusive of type'.  

Recently, Nikolajeva (1961) has published a  
comprehensive monograph on the family Hydnaceae of  
U.S.S.R., describing 124 species under 17 genera. She  
has further divided the traditional family Hydnaceae into
two subfamilies, namely, Odontioideae: Fructifications mostly resupinate or effused-reflexed, rarely pileate, lignicolous, and Hydnoideae: Fructifications mostly pileate and stipitate, rarely branched or resupinate to effused-reflexed, terrestrial or lignicolous. The two subfamilies are further divided into a number of tribes and subtribes. An outline of her classification of Hydnaceae is given below:

Family Hydnaceae

Subfamily Odontioideae Nikol.

1. Tribe Odontieae Nikol. **Grandinia Fr.**, **Aeulum Fr.**, **Odontia Fr.**, **Mycoleptodon Pat.**, **Irpex Fr.** and **Loparia Kelchbr. & M. Ow.**

2. Tribe Sarcodontieae Nikol. **Sarcodontia Schulz.**, **Climacodon Karst.** and **Mycoleptodonoides Nikol.**

Subfamily Hydnoideae Nikol.

1. Tribe Auriscalpieae Nikol. **Sclerodon Karst.**, **Auriscalpium Karst.**

2. Tribe Mucronelleae Nikol. **Mucronella Fr.**

3. Tribe Hericiaceae Nikol. **Hericium Fr.**

4. Tribe Hydneae Nikol.
   
   Subtribe Hydneinae (Donk) Nikol. **Hydnum Fr.**

   Subtribe Hydnellinae (Donk) Nikol. **Hydnellum Karst.**, **Phellodon Karst.**, **Sacrodon (Quel.) Karst.**

She has removed **Sistotrema**, **Caldesiella**, **Asterodon** and **Kavinia** from **Hydnaceae** and has placed these genera
in the allied families Thelephoraceae (Caldesiella, Sistotrema), Asterostromaceae (Asterodon) and Clavariaceae (Kavinia). However, she included under Hydnaceae the genera, Irpex and Loparia which are now generally dealt under Polyporaceae and Thelephoraceae respectively.

Harrison (1961-68) has made valuable contribution towards the knowledge of Hydnaceae in North America. In 1961, he made a monographic study of stipitate Hydnums of Nova Scotia (Canada). He has described 40 species under 9 genera in his monograph. In his publication entitled, 'New or little known North American stipitate Hydnums', 1964, he has described as many as 19 new species. He has used chemical tests of Melzer's reagent and KOH (3%) for differentiating various taxa at specific level. Recently, in his paper entitled, 'Studies on the Hydnums of Michigan. I.', 1968, he recognized 11 genera (strictly resupinate genera being not dealt with) for Hydnaceae sensu lato, from that region. These are given as below:

Echinodontium, Stegcherinum, Auriscalpium
Hericium, Gloiodon, Sistotrema, Hydnum,
Hydnellum, Phellodon, Dentinum and Bankera

Gilbertson (1962-65) has published excellent series of papers on the resupinate hydnaceous fungi of North America. He has made a critical study of the type material of a large number of species described by earlier American
and European mycologists, like C.H. Peck, M.J. Berkeley, M.A. Curtis, J. Bresadola, L.O. Overholts and O.G. Lloyd. He rendered many of the species described by these authors as synonyms of earlier validly published names and put them at their proper places and also proposed some new combinations.

Among other notable workers, who have contributed, from time to time, towards the knowledge of Hydnaceae are: Berkeley (1839-76), Berkeley & Broome (1873, 78), Berkeley & Curtis (1849, 69), Bresadola (1881-1926), Peck (1890-1900), Masseo (1892), Lloyd (1893-1925), Hennings (1900), Hoehnel (1905), Burt (1917, 31), Richen (1920), Killermann (1922-43), Pilat (1925-58), Wakefield (1930, 48), Jorstad (1932, 37), Lundell & Mannfeldt (1934-59), Lohwag (1931, 37), Wehmeyer (1935, 40), Wehmeyer & Sejp (1936), Listchauer (1939), Rick (1940, 59), Rogers & Jackson (1943), Snell et al. (1945-62), Henry (1948), Talbot (1951), Reid (1955-63), Pouzar (1956, 60), Boidin (1958) and Larsen (1964, 67).