TRANSACTIONS

OF

THE NORFOLK & NORWICH NATURALISTS' SOCIETY

Edited by E. A. ELLIS

VOL. 18 PART 3

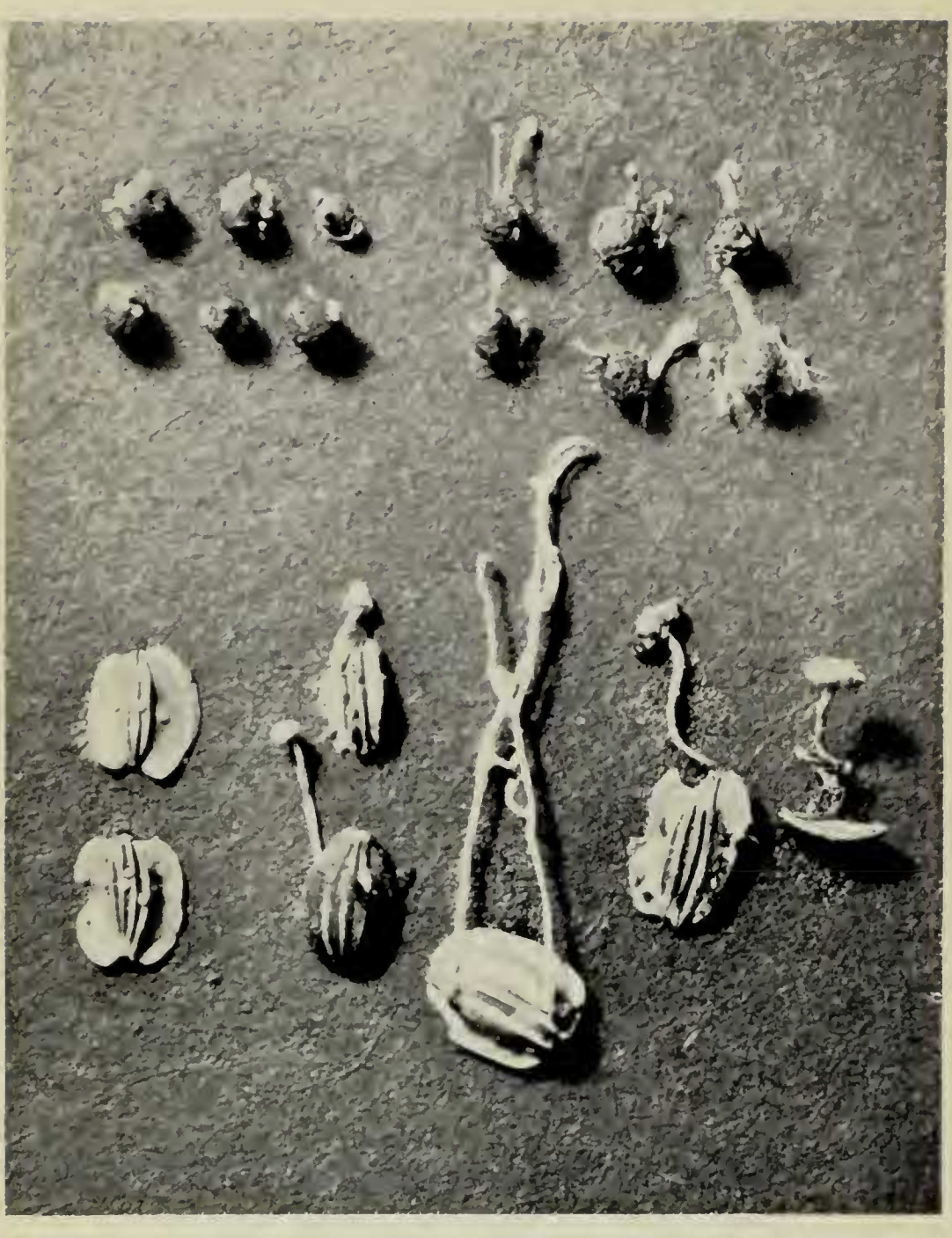
MYCOLOGY

CONTENTS

PRICE 5/-

Obtainable only from the Society.

NORWICH.
Printed by the Soman-Wherry Press Ltd., Norwich.
Published 17th December, 1956.



PHOTOGRAPH 1. Above : *Symphyosirinia galii* : primary and secondary synnemata and one apothecium on fruits of marsh bedstraw.

Below : *Symphyosirinia angelicae* : primary and secondary synnemata and apothecia on fruits of wild angelica and secondary synnemata on mericarps of milk parsley (2nd from left, bottom) and archangelica (largest specimen).

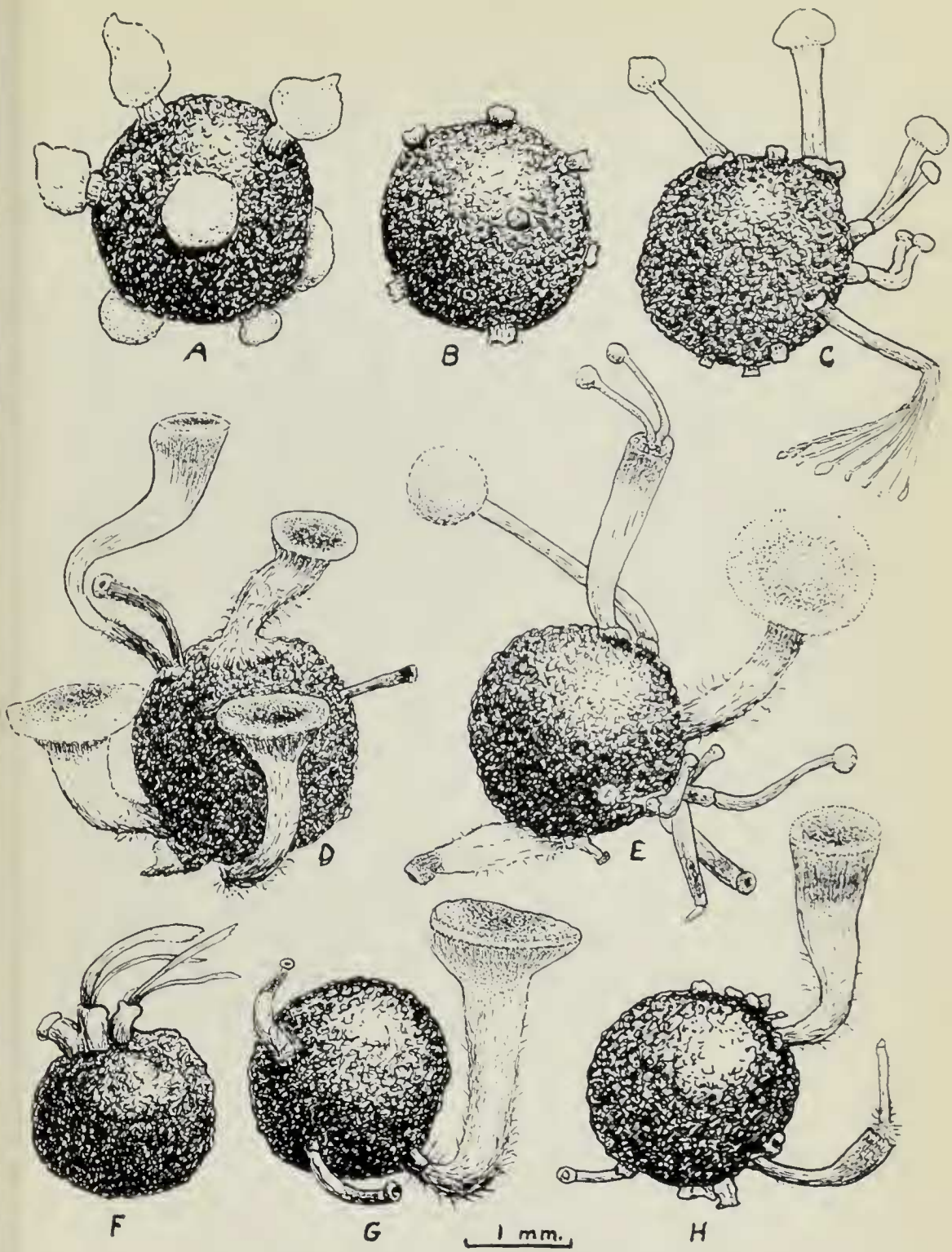


FIG. 1. *Symphyosirinia galii* ; on mericarps of *Galium palustre*, Wheatfen Broad, Surlingham, Norfolk.

A. Primary synnemata.
B. Bases of senile primary synnemata.
C. Secondary synnemata.
D. Apothecia.
E. Apothecia and secondary synnemata.
F. Immature secondary synnemata.
G. Apothecia.
H. Immature apothecia (one with a secondary synnema growing from its apex).

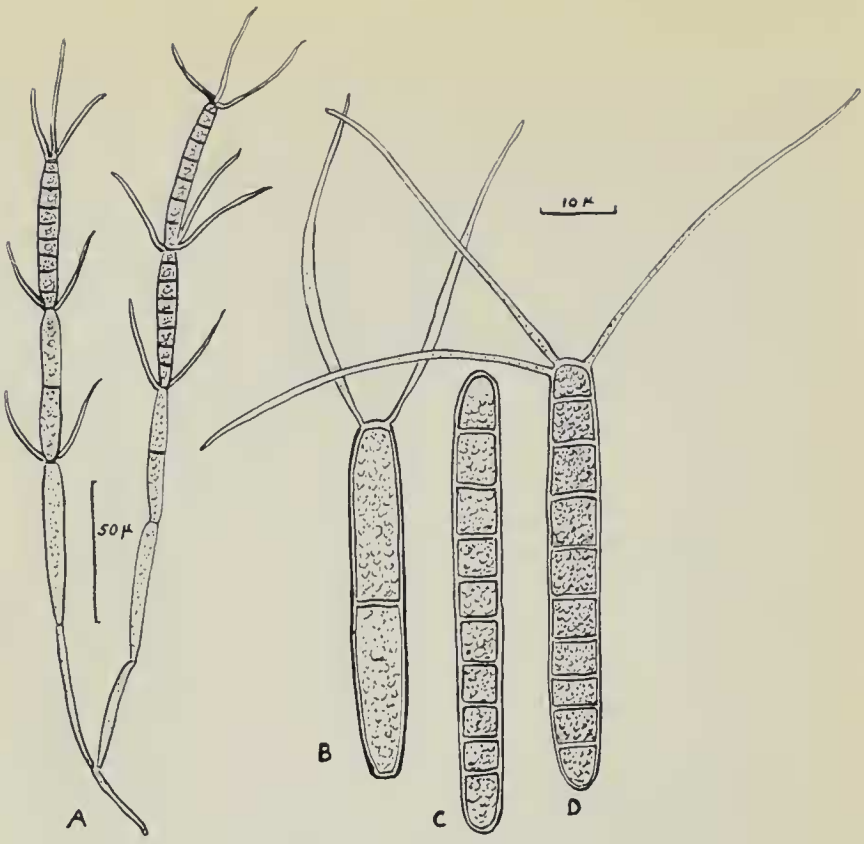


FIG. 2. *Symphyosirinia galii.*

A. Conidia on branching hyphae of a synnema.
B. Immature 1-septate conidium with two setae.
C. Mature conidium which has shed its setae.
D. Mature conidium with three setae.

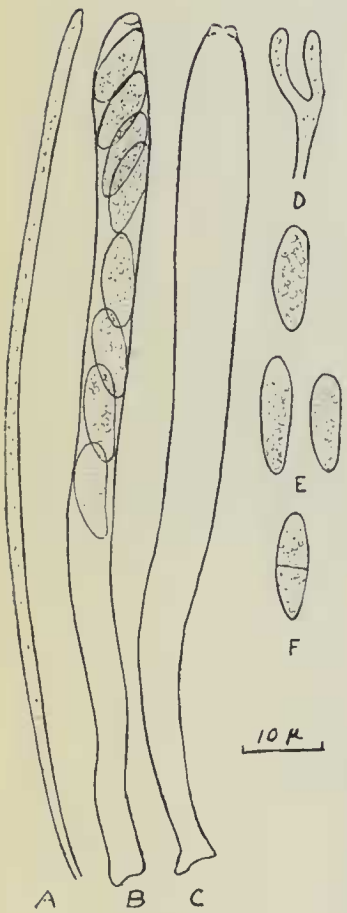


FIG. 3. *Symphyosirinia galii.*

A. Paraphysis.
B. Ascus with spores.
C. Empty ascus.
D. Forked tip of a paraphysis.
E. Ascospores as they are seen most commonly.
F. 1-septate ascospore.

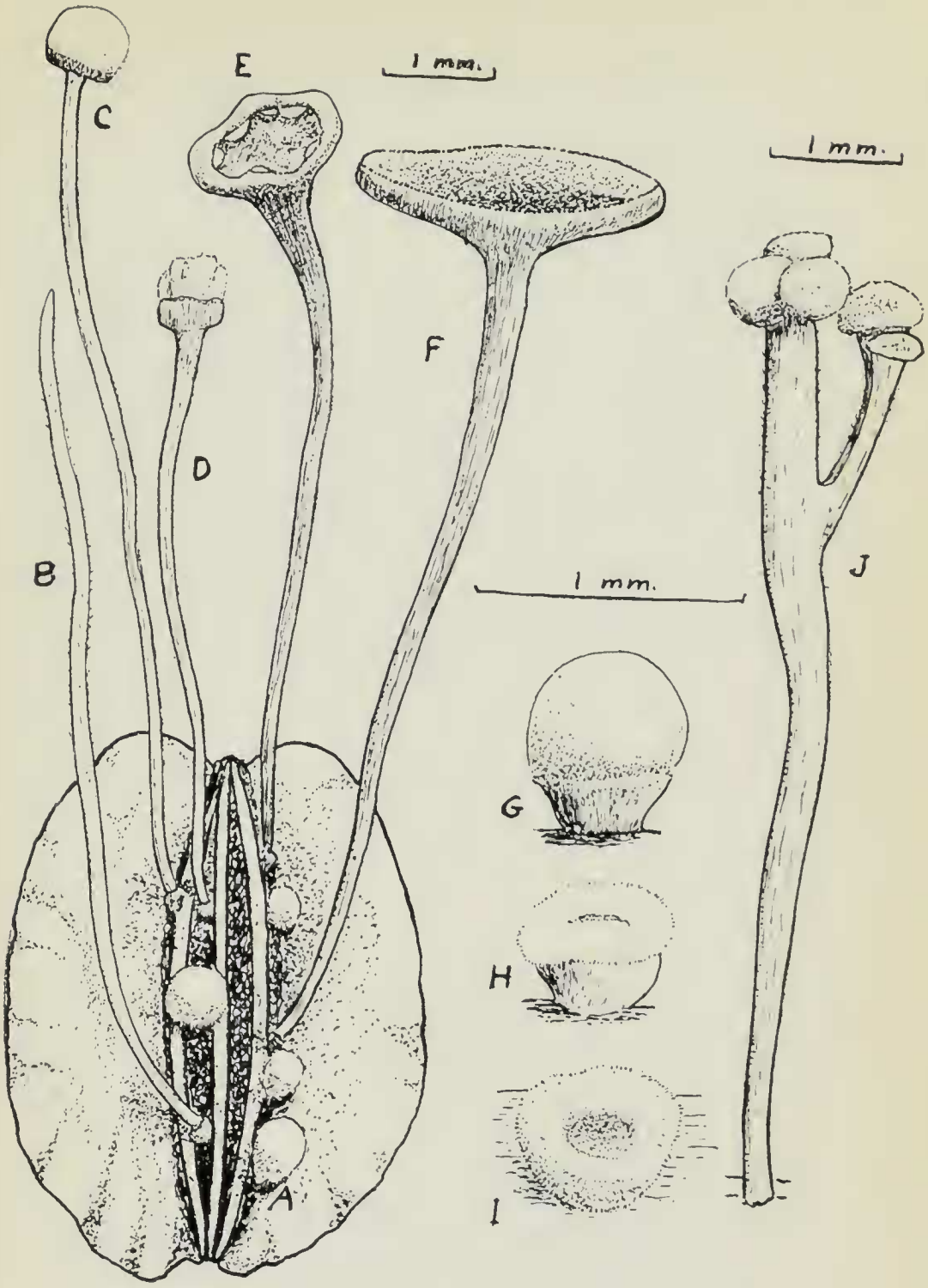


FIG. 4. *Symphyosirinia angelicae*.

A. Primary synnema.
B. Immature secondary synnema.
C. Typical secondary synnema sporulating.
D. Secondary synnema beginning to form an apothecium.
E. Apothecium with synnematal conidia still being abstricted from the margin of the disc.
F. Mature apothecium.
G, H, I. Primary synnemata.
J. Branched form of secondary synnema.

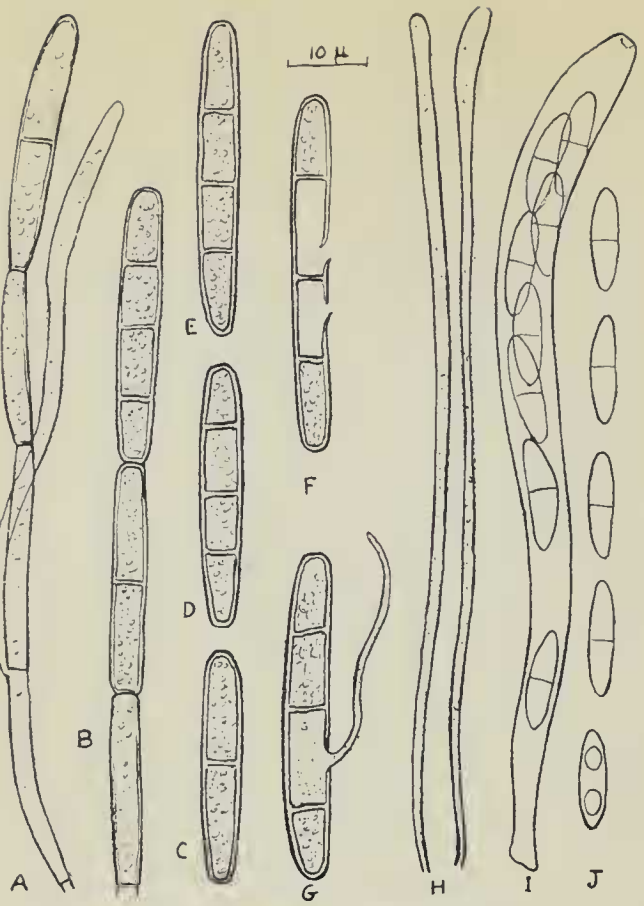


FIG. 5. *Symphyosirinia angelicae.*
A. Synnematal hyphae with conidia developing from the tips.
B. Three conidia from tip of sporulating hypha.
C. 1-septate conidium.
D, E. Mature conidia.
F. Old conidium after two cells have germinated.
G. Germinating conidium.
H. Paraphyses.
I. Ascus with spores.
J. Ascospores.

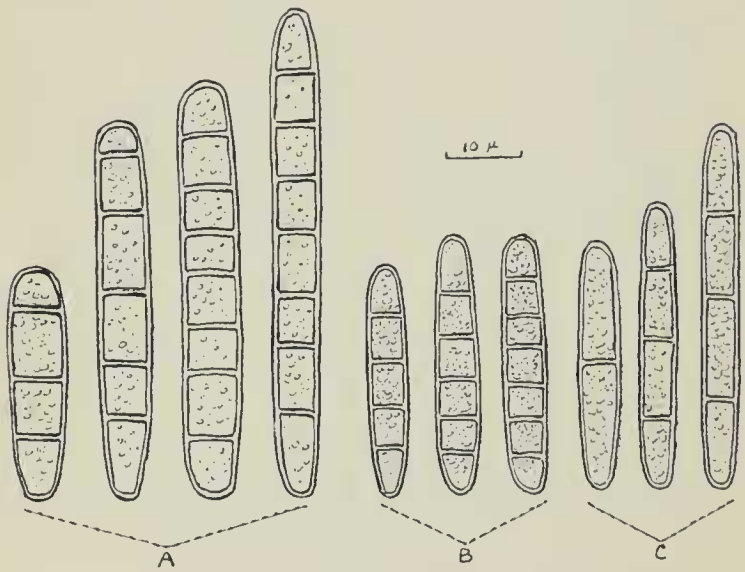


FIG. 6.
A. Conidia of *Symphyosira parasitica* Mass. & Crossl. (from the type collection).
B. Conidia of *Symphyosira rosea* Keissler.
C. Conidia of *Symphyosirinia angelicae.*
(All magnified to the same degree for comparison).

SYMPHYOSIRINIA, A NEW GENUS OF INOPERCULATE DISCOMYCETES.

By E. A. Ellis.

On 31st May, 1942, fallen fruits of the marsh bedstraw, *Galium palustre* L., in fen on Middle Marsh, Wheatfen Broad, Surlingham, Norfolk, were found parasitised by a fungus bearing white slimy heads of multiseptate, setose conidia formed in chains from branched hyphae in short synnemata. This fungus was classified provisionally as a hitherto undescribed hyphomycete of the genus *Symphyosira* Preuss, although it differed from the known species in that genus in possessing conidial setae. Subsequently, prolonged studies of the living fungus were made in the field and by means of controlled inoculation experiments. It was discovered that in the course of development, the short primary synnemata were succeeded by secondary long-stalked synnemata and by apothecia of an inoperculate discomycete having affinity with the Helotiales.

Parallel observations were made on another Norfolk fen fungus found to produce primary and secondary synnemata of *Symphyosira* type, followed by apothecia, on fallen fruits of wild angelica, *Angelica sylvestris* L. In the present paper, a new genus, *Symphyosirinia*, is proposed to accommodate these discomycetes.

Symphyosirinia E. A. Ellis gen. nov.

Apothecia e synnematibus specierum Symphyosirae exorientia, cupulata stipitata. Excipulum prosenchymatosum, totum ex hyphis homomorphis subparallelis constans. Asci inoperculati, 8-spori. Ascosporae uniseriatae vel in dimidio distali asci biseriatae, demum 1-septatae ; paraphyses cylindricae.

Typus generis : *S. galii* E. A. Ellis.

Apothecia originating from synnemata of a *Symphyosira*, cupulate, stipitate ; excipulum prosenchymatous, composed of uniform subparallel hyphae throughout. Asci inoperculate, 8-spored ; ascospores uniseriate or becoming biseriate in the distal half of the ascus, ultimately becoming 1-septate, hyaline ; paraphyses cylindrical. Type species *S. galii* E. A. Ellis. Structurally akin to *Gloeotinia* Wilson, Noble & Gray, but differing in the apothecia originating from synnemata and in occurring on dicotyledons.

Symphyosirinia galii E. A. Ellis sp. nov.

Synnemata primaria sessilia vel substipitata, alba ; secondaria carnosa, clavata, 1–3 mm. alta. Conidia cylindrica, obtusa, hyalina usque pallide olivacea, 7–9-septata, 35–60 × 5–7 μ, in cellula distali setas 1–3 usque ad 50 μ longas gerentia. Apothecia e synnematibus primariis senescentibus erumpentia, stipitata, cupulata, 1.0–1.5 mm. diametro, ad 3 mm. alta. Discus planus, immarginatus, pallide griseo-brunneus, asci cylindrico-clavati, 8-spori, 100–127 × 7–9 μ, poro iodo tincto haud caerulescente. Ascosporae uniseriatae, ovoideae, continuae vel 1-septatae, hyalinae, 10–15 × 3.5–4 μ. Paraphyses cylindricae, 2 μ latae. Excipulum prosenchymatosum. Habitat in fructibus caducis *Galii palustris*.

Synnemata of two kinds, primary and secondary. Primary synnemata sessile or substipitate, white, composed of closely adhering branching hyphae abstricting from their tips phragmosporous slime-spores in basipetal succession. Conidia cylindrical, 35–60 × 5–7 μ, obtuse at each end, hyaline to faintly olivaceous with granular contents, 7–9-septate at maturity and normally bearing 1–3 setae up to 50 μ long on the distal cell. Secondary synnemata fleshy clavate, 1–3 mm. high, the stalks white or yellowsih white, composed of long interwoven hyphae bearing slimy conidia similar to those of the primary synnemata ; conidia white to rosy-white in the mass. Apothecia developed from the basal tissue of senile primary synnemata ; disc flat or slightly convex, immarginate, light greyish brown or, rarely, white, 1.0–1.5 mm. across ; receptacle cupulate, concolorous with the disc or with a paler pruinose margin, seated on a flexuose, cylindrical or obconical, often minutely hairy stalk, 300–700 μ thick and up to 3.0 mm. long. Excipulum composed throughout of parallel, thin-walled, non-gelatinised hyphae, *c.* 5 μ wide, with light brown walls, not clearly differentiated from the hyphae of the flesh and commonly running out at their tips into slender, obtuse, thin-walled septate hairs. Asci cylindric-clavate, 100–127 × 7–9 μ, 8-spored, without croziers, pore in fresh specimens not blued by iodine ; ascospores uniseriate, ovoid, 10–15.0 × 3.5–4.0 μ, hyaline, with granular contents, continuous or ultimately 1-septate, not constricted at the septum ; paraphyses numerous, cylindrical, 2 μ wide, rounded and occasionally forked at the tip.

Parasitic on fallen mericarps of *Galium palustre* L., in fens, Norfolk, England. Type : apothecia and secondary synnemata, Wheatfen Broad, Surlingham, Norfolk, October, 1956 ;

primary synnemata, from the same locality, collected 31st May, 1942 : deposited in Herb. Royal Botanic Gardens, Kew.

S. galii was abundant in its type locality from 1942 to 1949. Primary synnemata were found in every month of the year ; secondary synnemata and apothecia were seen in the open only in September and October, although some were produced at other seasons in the course of inoculation experiments. In the autumn of 1949 the fungus received a severe setback in its natural habitat owing to the almost complete failure of the marsh bedstraw to produce fruits in that year. Annual searches made for *S. galii* proved unsuccessful from 1950 to 1955 inclusive ; but in June, 1956, the fungus was rediscovered at Wheatfen. *S. galii* occurs typically in low-lying, frequently-flooded fens, where its host, the large-fruited octoploid marsh bedstraw grows in a straggling fashion amongst reeds and sedges. The phanerogamic vegetation of a habitat of *S. galii* on Home Marsh, Wheatfen Broad, June, 1956 was as follows :

abundant :

Carex elata ... ... Tufted Sedge
Galium palustre ... ... Large Marsh Bedstraw
Phragmites communis ... Common Reed

common :

Equisetum palustre ... Marsh Horsetail
Eupatorium cannabinum Hemp Agrimony
Mentha aquatica... ... Water Mint
Myosotis palustris ... Water Forget-me-not
Oenanthe fistulosa ... Water Dropwort

frequent :

Agrostis stolonifera ... Creeping Bent
Angelica sylvestris ... Wild Angelica
Caltha palustris ... ... Marsh Marigold
Calystegia sepium ... Bellbine
Carex riparia ... ... Great Pond Sedge
Cladium mariscus ... Sedge
Filipendula ulmaria ... Meadowsweet
Iris pseudacorus... ... Yellow Flag
Juncus subnodulosus ... Fen Rush
Lysimachia vulgaris ... Yellow Loosestrife
Lythrum salicaria ... Purple Loosestrife

occasional :

Berula erecta	...	Narrow-leaved Water Parsnip
Carex appropinquata	...	Small Tussock Sedge
Glyceria maxima	...	Reed Sweet-grass
Peucedanum palustre	...	Milk Parsley
Ranunculus repens	...	Creeping Buttercup
Rumex hydrolapathum	...	Great Water Dock
Stachys palustris	...	Marsh Woundwort
Thalictrum flavum	...	Meadow Rue
Valeriana officinalis	...	Valerian

Ripe fruits of the marsh bedstraw commonly become lodged on the lower leaves of associated marsh plants, especially those of *Carex elata* dipping in the water. The shed mericarps reach various levels subsequently as flood waters rise and fall. Spores of the parasitic fungus are dispersed by water from infected fruits of the previous year and make contact effectively with the new season's fruits where tidal freshwater flooding is of frequent occurrence, as it is in the " rond " fens of the Yare Valley and some other parts of the Norfolk Broads. The long hair-like appendages on the conidia of *S. galii* resemble those of many aquatic hyphomycetes ; their biological function is not known, but they give stability and buoyancy to spores suspended in water and increase the chances of spores becoming entangled with vegetation ; it is probable that they also conserve moisture when spores are left high and dry after floods.

Inoculation Experiments.

On 6th February, 1944, 25 mericarps of *Galium palustre* were inoculated with conidia from primary synnemata of *Symphyosirinia galii* by being dipped in a spore-suspension. They were placed on sterilised silver sand wetted with boiled rain-water, in a petri-dish, and kept in a rather dim, cool room. On 24th March, 16 inoculates bore 1 to 15 primary synnemata of the pathogen and three unaffected mericarps had begun to germinate. By 6th April, 22 inoculates bore synnemata (i.e., all except the three which had germinated). By 21st June most of the synnemata had ceased active sporulation and had become reduced to yellowish, horny, basal stumps. On this date a single long-stalked fruiting body was seen to be growing

from one synnema base on each of two mericarps. By 28th July, 21 of the inoculates had produced from 1 to 7 secondary, long-stalked synnemata and immature apothecia. Further experiments were carried out on similar lines in 1944 and 1945, except that in most cases the inoculates were kept on strips of moistened cellulose wadding instead of on silver sand. It was found that under varying conditions of saturation, illumination and temperature, the primary synnemata first appeared on the mericarps 21–60 days and most commonly 33 days after inoculation, at room temperatures, in a moderate light, when the mericarps were well wetted. The sporulation of primary synnemata usually continued for about two months ; this was followed by a resting period of from three to five weeks, after which, secondary synnemata and apothecia grew from the basal stumps of the primary synnemata. Secondary synnemata began to sporulate about four weeks after making their first appearance. Apothecia took from two-and-a-half to three months to attain maturity from the time they first appeared. In some cases the development of apothecia became arrested before maturity and stalked synnemata were produced from their unexpanded tips. " Clean " mericarps were used as controls throughout these experiments and in most cases 100 per cent germinated successfully, although it was not unusual for a proportion of them to germinate three months or more after the majority. In no instance was a mericarp found to germinate after synnemata of *S. galii* had developed on it ; in a very few cases radicles emerged from inoculated mericarps before synnemata had appeared, but death of the host occurred very shortly afterwards as the fungus developed.

S. galii has not been seen growing on any substrate other than fallen fruits of the type host under natural conditions ; but in November, 1944, 68 out of 75 mericarps of *Galium uliginosum* were inoculated successfully with the *Symphyosirinia* conidia and in due course produced primary and secondary synnemata ; no apothecia were formed. In January, 1945, this experiment was repeated and the inoculation of a further 25 mericarps of *G. uliginosum* proved 100 per cent successful ; again, no apothecia were produced. Fruits of *G. uliginosum* are much smaller than those of the normal host and this may account for the parasite's failure to produce apothecia on them.

S. galii has been collected outside its type locality on two occasions, viz., at Rush Hills, Hickling Broad, Norfolk, 10th July, 1945, and at Strumpshaw Broad, Norfolk, 3rd April, 1949. Five specimens with white apothecia were seen at Wheatfen in October, 1956.

The *SYMPHYOSIRINIA* parasitising fallen mericarps of *ANGELICA SYLVESTRIS*.

Whereas no historical complications were encountered in dealing with *S. galii*, the second fungus considered here has been assumed by various authors from 1882 onward to be of the same species as a discomycete described by Bulliard in 1784 as *Peziza subularis*. Bulliard described his fungus as " Peziza tenuis, fragilis, glabra, lateritia, in stipitem longissimum et gracilem desinens ; craterâ cyathoideo-cupularis " and stated that it grew on half-decayed fruits of the annual sunflower (*Helianthus annuus*) and tripartite bur-marigold (*Bidens tripartitus*) in spring and autumn, in fields, woods and gardens in France. He figured it growing unmistakably on these fruits and while mentioning that it was very variable in size, failed to provide measurements and gave no details of its microscopic characters. Its colour he described as " d'un rouge de brique."

In October, 1879, Rev. J. Keith collected specimens of a discomycete growing on fallen mericarps of *Angelica sylvestris* at Forres, Scotland. These were recorded by Stevenson, 1882, as " *P.* (*Hymenoscypha*) *subularis* Bull." and measurements of the ascospores were given as 17–20 × 4–5 μ. Phillips, 1893, amended Bulliard's description of *P. subularis* to include details of Keith's Scottish specimens and it is important to note that he pointed out that in the Forres material examined by him, the exterior of the apothecium was nearly white and the disc very pale brown (not brick red, as described for Bulliard's fungus). Specimens collected by Rev. J. Keith at Forres, October, 1879, are preserved in Herb. W. Phillips at the British Museum (Natural History). When I examined them in 1947, they consisted of three mericarps of *Angelica sylvestris* bearing respectively (a) one mature apothecium and one immature apothecium, (b) one mature apothecium and one secondary synnema of a *Symphyosira* with 3-septate conidia and (c) one mature apothe-

cium and one immature apothecium with *Symphyosira* conidia borne on the peripheral hyphae.

I have no doubt that Keith's specimens represent a fungus of the same species as the fungus which has been found growing commonly on fallen fruits of *Angelica sylvestris* in Norfolk in recent years and which I have studied intensively since 1940. On the evidence now available, it appears improbable that Stevenson, Phillips and others were correct in referring Keith's fungus to *Peziza subularis* Bull. The discs of the apothecia occurring on *Angelica* fruits are not truly cyathiform ; the apothecia are not brick red and it has not been found possible to infect fruits of *Bidens tripartitus* or *Helianthus annuus* with the *Angelica* fungus. A new name is proposed here for the Forres and Norfolk material and the British fungus is described afresh as follows :

Symphyosirinia angelicae E. A. Ellis sp. nov.

Synnemata primaria sessilia, alba vel pallide rosacea ; secondaria carnosa, clavata, 3–27 mm. alta. Conidia cylindrica, obtusa, hyalina usque pallide olivacea, 1–3 septata, 23–47 × 4–6 μ, haud setosa. Apothecia stipitata, cupulata, 2–4 mm. diametro, ad 30 mm. alta. Asci cylindrico-clavati, 95–110 × 6.5–8 μ. 8 spori, poro iodo tincto haud caerulescente. Ascosporae uniseriatae vel biseriatae, ovoideae, 1-septatae, hyalinae, 12–20 × 3.5–5 μ. Paraphyses cylindricae, 1–2 μ latae. Excipulum prosenchymatosum. Habitat in fructibus caducis *Angelicae sylvestris*.

Synnemata of two kinds, primary and secondary. Primary synnemata sessile, white or rosy white, composed of closely adhering branching hyphae abstricting from their tips phragmosporous slime-spores, which are produced in basipetal succession. Conidia cylindrical, 23–47 × 4–6 μ (commonly 30–37 × 5–6 μ), obtuse at each end, hyaline (faintly olivaceous when old), with granular contents, 1–3-septate at maturity and without setae. Secondary synnemata fleshy clavate, 3–27 mm. (commonly 6–12 mm.) high, the stalks white or yellowish white, 0.5 mm. thick, composed of long interwoven hyphae bearing slimy conidia similar to those of the primary synnemata ; conidia rosy-white in the mass. Apothecia usually solitary, developed from the bases of senile synnemata ; disc saucer-shaped, sometimes becoming flat, immarginate or surrounded by a fringe of conidia borne on synnematal hyphae externally until the apothecium is fully developed, light brown, 2–4 mm. across ;

receptacle cupulate, paler than the disc, seated on a flexuose, cylindrical stalk, slightly attenuated towards the base, smooth or with a few minute hairs, 300–800 μ thick and 5–30 (commonly 10) mm. high. Excipulum composed throughout of parallel, thin-walled, non-gelatinised hyphae, *c.* 5 μ wide, not clearly differentiated from the hyphae of the flesh ; in some specimens the outermost hyphae abstrict conidia at the periphery of the disc. Asci cylindric-clavate, 95–110 × 6.5–8.0 μ, 8-spored, without croziers ; pore in fresh specimens not blued by iodine. Ascospores uniseriate or biseriate in the upper half of the ascus, ovoid, 12–20 × 3.5–5.0 μ, hyaline, becoming 1-septate, not constricted at the septa ; paraphyses numerous, cylindrical, 1–2 μ wide, rounded and sometimes very slightly clavate.

Parasitic on fallen mericarps of *Angelica sylvestris* in marshes, England, Scotland ; conidial synnemata also occurring naturally on fallen mericarps of *Peucedanum palustre* and *Oenanthe fistulosa* in fens, Norfolk and produced by artificial inoculation on fruits of other Umbelliferae. Type material deposited in Herb. Kew : primary synnemata, on *Angelica sylvestris*, Parish Marsh, Wheatfen Broad, Surlingham, Norfolk, 25th February, 1943 ; secondary synnemata, and apothecia, on the same host, Wheatfen Broad, 12th October, 1956.

Observations made on *S. angelicae* in Norfolk, 1940–56 :

In October, 1940, stalked synnemata of a *Symphyosira* on fallen mericarps of milk parsley (*Peucedanum palustre*) were collected from a sedge fen at Wheatfen Broad, Norfolk. Between 1941 and 1956 numerous collections of this fungus were made on the same host fruits in fens of the Yare Valley and on fallen fruits of *Angelica sylvestris* in fens and water meadows in many places in Norfolk. Apothecia of an inoperculate discomycete associated with the *Symphyosira* and in some cases palpably developing from its synnemata were found at Wheatfen Broad and Old Lakenham in October, 1941 and in numerous East Norfolk localities during October and November in subsequent years.

The life history of this fungus was investigated by means of more than fifty inoculation experiments conducted mainly in 1943–45. It was found that sessile primary synnemata developed on new mericarps of *Angelica sylvestris* from the 26th day onward, following inoculation with conidia taken

from secondary synnemata on the old fruits. Primary synnemata commonly appeared on 100 per cent of the inoculates by the end of two months. These synnemata continued to produce conidia actively for two to three months, after which, they became quiescent. Later, stalked secondary synnemata and in some cases apothecia developed from the basal tissues of the primary synnemata. The secondary synnemata usually commenced sporulation in four to five months after the original inoculation.

Mericarps of *A. sylvestris* were inoculated successfully with conidia taken from those of *Peucedanum palustre* and *vice versa ;* but in each case the percentage of infection was less and the growth of the fungus slower when the host species was changed. Mericarps of other species of Umbelliferae were inoculated with the conidia and in many cases the fungus produced sporulating primary and secondary synnemata on them ; but apothecia were seen only on *Angelica sylvestris*. Some of the information obtained in the course of these experiments is given below.

Mericarps of Umbelliferae were inoculated by dipping them in suspensions of conidia of *Symphyosirinia angelicae ;* they were placed on strips of cellulose wadding saturated with boiled rain water and kept under observation in petri dishes and glass tubes in a moderate light at room temperatures. Ten or more mericarps were inoculated in each instance and an equal number of controls was kept. No *Symphyosirinia* was found to develop on any of the controls, which in most cases produced healthy seedlings in due course.

(a) mericarps inoculated with conidia from *Angelica sylvestris*
(b) mericarps inoculated with conidia from *Peucedanum palustre*.

Inoculate	Infection	Period of observation
Angelica archangelica	(b) 60%	300 days
Anthriscus sylvestris	(b) Nil	133 ,,
Apium dulce	(b) 37%	249 ,,
Cicuta virosa	(a) 50%	349 ,,
Cicuta virosa	(b) 80%	238 ,,
Conium maculatum	(a) Nil	196 ,,
Conium maculatum	(a) Nil	184 ,,
Conium maculatum	(b) Nil	184 ,,

Inoculate	Infection		Period of observation
Conium maculatum	(b)	Nil	50 days
Conium maculatum	(b)	10% (synnemata sterile)	199 ,,
Daucus carota sativus	(b)	10% (synnemata sterile)	238 ,,
Heracleum sphondylium	(a)	Nil	335 ,,
Heracleum sphondylium	(a)	50% (synnemata sterile)	260 ,,
Heracleum sphondylium	(b)	Nil	244 ,,
Heracleum sphondylium	(b)	Nil	134 ,,
Oenanthe fistulosa	(a)	Nil	249 ,,
Oenanthe fistulosa	(b)	Nil	134 ,,
Oenanthe fistulosa	(b)	40%	418 ,,
Oenanthe lachenalii	(a)	30%	249 ,,
Oenanthe lachenalii	(a)	50%	249 ,,
Oenanthe lachenalii	(b)	80%	341 ,,
Pastinaca sativa	(a)	70%	336 ,,
Petroselinum crispum	(b)	90%	238 ,,
Smyrnium olusatrum	(a)	100%	349 ,,
Smyrnium olusatrum	(b)	100%	238 ,,

Sporulating primary and secondary synnemata were obtained where positive infection occurred except as indicated above.

In all cases, mericarps failed to germinate successfully when infected by *S. angelicae.*

It was observed that the sporulating synnemata of both *S. galii* and *S. angelica* remained free from invasion by other fungi, bacteria and even myxomycetes. In their natural habitat they were found to be attacked by mycophagous mites to a small extent and on one occasion swarms of amoebae were discovered to be present in a sliming primary synnema head of *S. galii.* Large numbers of molluscs are present in the fens where these fungi grow (see A. E. Ellis, " The Mollusca of a Norfolk Broad, *Journ. Conch.* 21, 224–243, 1941), but both kinds of *Symphyosirinia* are little troubled by them ; on two occasions the small snail *Euconulus fulvus* has been seen to devour conidia of *S. galii. S. angelicae* has been found producing secondary synnemata and apothecia in abundance where the slug *Agriolimax agrestis* and the snail *Ashfordia granulata* were particularly numerous.

In view of the fact that Bulliard's *Peziza subularis* was found growing on fruits of *Helianthus annuus* and *Bidens tripartitus,*

attempts were made in 1944–45 to infect fruits of these two species by inoculating them with spores of the *Angelica* fungus. Ten mericarps of *H. annuus* and ten of *B. tripartitus* were dipped in suspensions of conidia taken from secondary synnemata of *S. angelicae* on *Angelica sylvestris* and ten of each were inoculated similarly with conidia from mericarps of *Peucedanum palustre*. The inoculates were kept under observation for 339 days with a negative result in each case.

Symphyosirinia angelicae and *Symphyosira parasitica*.

At this point it is relevant to mention that on 25th September, 1899, a stalked *Symphyosira* was found growing on fallen fruits of hemlock (*Conium maculatum*) and on one mericarp of hog-weed (*Heracleum sphondylium*) in a wood on the borders of Sutton, near Askern, Yorkshire, by A. Clarke. Massee and Crossland, *Naturalist*, 1904, p. 6, gave a detailed account of this fungus and described it as a new species, *Symphyosira parasitica*. The synnemata were described as " pallid, 6–14 mm. high " and the conidia as " cylindrical, 3–5-septate, hyaline, 40–70 × 6–8 μ." No figure was published, but good specimens of the original material exist in Crossland's herbarium at Kew. In a sample taken at random from this collection I found that 35 out of 43 conidia were 7-septate ; three had 5 septa and the remainder, 3 septa ; the dimensions of the conidia I found to be 30–61 × 6–8 μ (exceptionally 10 μ). While superficially *S. parasitica* bears some resemblance to the secondary synnemata of *S. angelicae*, it has constantly larger conidia with more numerous septa in them than those of the latter. This fact, taken together with the negative results of attempts made to infect mericarps of *Conium* and *Heracleum* with *S. angelicae* leads one to the conclusion that two distinct species of fungi are being dealt with. *S. parasitica* has not been rediscovered in Yorkshire since Massee and Crossland described it ; but while this paper was in proof, I found it growing on fallen mericarps of *Pimpinella major* L. in a clayey meadow at Torr, Yealmpton, S. Devon, 27th October, 1956.

Symphyosira Preuss.

The genus *Symphyosira* was erected by Preuss : F. Hoyersw., n. 60, *Linnaea* XXV, 742, 1852, for a single species which he

named *S. lutea*, one of the Fungi Imperfecti (Moniliales : Stilbaceae : Hyalophragmiae). The chief generic characters given were the possession of fleshy clavate synnemata, coalescing at the base and separating above into chains of conidia, 1–3-septate. *S. lutea* Preuss was described from material growing on rotten pine wood in Germany ; it was characterised as having clavate synnemata, yellowish to white above, with the conidia cylindrical, hyaline (white), 1–3-septate. No figure was provided and no measurements were given. Keissler (1913) found Preuss's original material useless as a type specimen and the fungus does not appear to have been collected again under this name.

Karsten (1891) described as a second species *S. alba*, from a specimen found growing on old wood, believed to be *Pinus*, in Finland. He characterised it as having the synnemata few or gregarious, fleshy, stipitate-clavate, smooth, with the heads sphaeroidal to lentiform, white, 0.1–0.3 mm. across and with the stalks short and yellowish ; he described the conidia as growing in chains, cylindrical, obtuse at the apex, straight, hyaline, pluriguttulate and measuring usually 36 × 3 μ. Keissler (1913) considered *S. alba* Karsten to be a synonym of *S. lutea* Preuss. Karsten's type specimen could not be found and "*S. alba*" does not appear to have been collected again. Massee and Crossland (1904) were the next to describe a *Symphyosira* (*S. parasitica*), referred to earlier in this paper. Keissler : Uber die Gattung Symphyosira. *Myc. Centr.* Bd. ii, Heft 7, 322, 1913, described a further species, *S. rosea*, collected from woodland soil in the Tyrol. It was characterised by the following features : synnemata stalked-capitate, simple, fleshy, smooth, the stalks pale (brownish under the microscope), slender, curved above, 3–5 × 0.2 mm., the heads distinctly sphaeroid, pale rose-coloured and about 1 mm. in diameter ; conidia cylindrical, obtuse at the apex, straight, concatenate, granular, non-guttulate, 3–6 (commonly 4–5)-septate, subhyaline and measuring 27–33 × 6 μ. In 1946, Dr. F. Petrak informed me that type material of *S. rosea* existed in the herbarium of the Naturhistorisches Museum, Wien.

In 1867, Crouan, *Florule du Finistere*, p. 13 described a hyphomycete found growing on dead fruits of *Angelica sylvestris* in France and named it *Fusidium angelicae ;* it was transferred to *Cylindrium* by Saccardo : *Sylloge Fungorum* iv, 38, 1886. From

the description, it appears likely that Crouan's fungus consisted of primary synnemata of *Symphyosirinia angelicae*, examined at an early stage, before septa had been formed in the conidia.

ACKNOWLEDGMENTS.

I thank Dr. R. W. G. Dennis for much kind advice and assistance given in a number of ways while this account was being planned and prepared, and Mr. N. Y. Sandwith for the Latin diagnoses. I should also like to thank the authorities at the British Museum (Natural History) for allowing me to examine Keith's Scottish specimens of " *Peziza subularis* " from Forres. In the early stages of this investigation, I remember specially the kind encouragement received from Dr. G. E. Deacon and Mr. E. W. Mason.

THE ERGOT ON *ELEOCHARIS* IN NORFOLK

By R. W. G. Dennis and E. A. Ellis

All Norfolk botanists must be familiar with the ergots, sclerotia of *Claviceps purpurea* (Fr.) Tul., so common in the ears of grasses and occasionally of cereals, though the ascogenous stromata which arise from the fallen ergots in the following year are less often noticed. Races of this fungus are known in Norfolk on species of *Agropyron, Alopecurus, Ammocalamagrostis, Ammophila, Anthoxanthum, Brachypodium, Dactylis, Deschampsia, Elymus, Festuca, Glyceria, Holcus, Lolium, Molinia, Phleum, Phragmites, Poa, Secale* and, rarely, on *Triticum.* Much less common is the ergot affecting the Cyperaceous genus *Eleocharis.* This was described just over a century ago by Tulasne as a distinct species, *Claviceps nigricans* Tul., distinguished from *C. purpurea* by the very dark violet colour of its stromata.

The ergot of *Eleocharis* is by no means common. So far, it has been detected in the following Norfolk localities, in each case on the common spike-rush, *Eleocharis palustris :* Gresham School Woods, Holt, October 10th, 1954 ; Mulbarton Common, August 26th, 1955 and March 30th, 1956 and Horsey Warren, August 27th 1955. Outside this county, Petch (1938) knew it from Poole Heath, Dorset ; Hengistbury Head, Hampshire and Clatto Reservoir, Fife. More recently, one of us (E. A. E.) collected it on *Eleocharis multicaulis* and *E. palustris* at Studland Bay, Dorset, September 2nd, 1954 and specimens on *E. palustris* were sent to Kew from Thursley Common, Hindhead, Surrey, September 26th, 1954. Hitherto, all the British material has consisted solely of ungerminated sclerotia.

In August 1955 one of us (E. A. E.) observed copious infection of the heads of *Eleocharis palustris* growing in shallow water near the margin of the village pond at Mulbarton, 4 miles west of Norwich. On March 30th following we revisited this locality to collect overwintered ergots with a view to germinating them and obtaining the ascogenous stromata. By this time the last year's *Eleocharis* shoots were much decayed and only a few recognisable fruiting heads could be found with ergots still inserted in them. Abundant fallen ergots were,

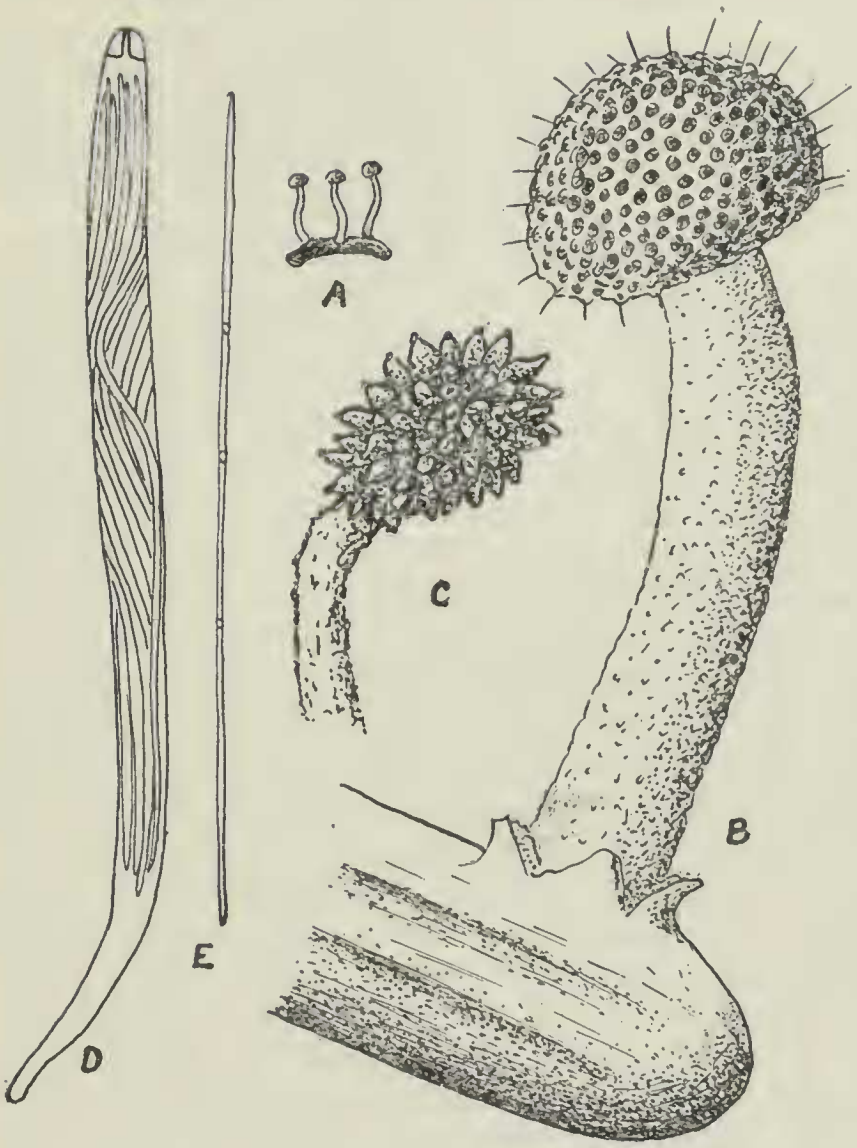


FIG. 1. *Claviceps nigricans.*

(a) Stromata on ergot.
(b) Stroma showing hair-like bundles of spores protruding from the perithecia.
(c) Old perithecia.
(d) Ascus.
(e) Ascospore.

For measurements, see text.

however, floating on the surface of the pond in the *Eleocharis* bed which fortunately forms a pure stand unmixed with grasses. Ergots from the Mulbarton pond were set to germinate on cotton wool soaked with river water in a corked glass tube on April 7th, 1956 and left on a window sill exposed to daylight at room temperature, approximately 65–70°F. By April 23rd, 1956 a few had developed mature ascospores and during the following week the majority had germinated freely.

Each sclerotium usually produces about 3–4 stromata, very similar in appearance to those of *C. purpurea.* Each has a slender, cylindrical, usually somewhat curved stalk, up to about 4 mm. tall and 0.5 mm. thick, which varies in fresh colour from light mauve to deep dull blueish violet (Ridgway). The head is pulvinate, from 0.75–1.25 mm. across, thickly studded with the dark papillate ostioles of the embedded perithecia. The ground colour of the head varies from cinnamon-buff to orange-cinnamon, as seen under a binocular microscope at about x 20, and that of the perithecial tips from Indian red to burnt umber or darker. To the unaided eye these colours become somewhat blended and give the impression of a dark reddish purple head. Stalk and head alike become almost black when dried and in over-ripe material the perithecia stand out nakedly from the stromatic surface, like those of some species of *Cordyceps ;* in this it differs markedly from *C. purpurea.* When fresh stromata are removed from the saturated atmosphere of the glass tube to the dry air of a room ascospore discharge is accelerated and extrusion of the asci from the ostioles can be readily observed under the binocular. Many bundles of asci remain protruding from the ostioles, so that the head becomes set with waving white hairs, as in the apothecia of the Ostropaceous genus *Vibrissea.* The asci are narrowly cylindrical, short-stalked, about 84–100 x 4.5–5.5 μ, distinctly capitate with solid hemispherical tips pierced by a central pore which is not stained blue by Melzer's reagent. The number of ascospores is difficult to count precisely, but it is certainly more than 4 and presumably 8. They lie approximately parallel in the ascus, sometimes spirally coiled in its middle part, and measure about 78–92 x 1 μ. When freshly shed they appear to be non-septate though there are often three clear spots in their contents, best seen in spores stained with cotton blue. There are no paraphyses.

WHITE RUSTS AND DOWNY MILDEWS IN NORFOLK

By E. A. Ellis

The study of the parasitic downy mildews and their allies in this county has been greatly neglected and the following list of Norfolk species noticed by the writer is given with a view to stimulating research in this direction.

Peronosporaceae (Downy Mildews) :—

Peronospora affinis Rothmann, on *Fumaria officinalis*, Hellington, 1.7.1943 ; *alsinearum* Casp., common on *Cerastium vulgatum* and *Stellaria media ; alta* Fckl., common on *Plantago major ; antirrhini* Schroet., on *Antirrhinum orontium*, Brundall, 1943 ; *arborescens* (Berk.) de Bary, on *Papaver rhaeas*, Upper Hellesdon, 1941 and on *Papaver lecoquii*, Old Lakenham, 1943 ; *calotheca* de Bary, very common on *Galium aparine*, on *Asperula odorata* at Arminghall, 1939 and on *Sherardia arvensis* at Saxlingham, 1944 ; *candida* Fckl., on *Primula vulgaris*, Hoveton, April, 1954 ; *conglomerata* Fckl., on *Geranium pusillum*, Brundall, 1944 ; *debaryi* Salmon & Ware, common on *Urtica urens ; destructor* (Berk.) Casp., common on cultivated onions ; *effusa* (Grev. ex Desm.) Rab., very common on *Chenopodium album*, various species of *Atriplex* and cultivated spinach ; *ficariae* Tul., common on *Ranunculus ficaria* and *R. repens*, found also on *R. bulbosus* at Brundall, 1944 and on *R. flammula* at Strumpshaw, 1943 ; *grisea* Unger, not uncommon on *Veronica arvensis*, *V. persica* and *V. serpyllifolia ; lamii* (A. Braun) de Bary, common on *Lamium purpureum* and found on *Stachys palustris* at Norwich, 1940 ; *linariae* Fckl., on *Linaria vulgaris*, Strumpshaw, 1944 ; *parasitica* (Pers. ex Fr.) Tul., common on cultivated cabbages, stocks and wallflowers, seen also on *Diplotaxis muralis*, *Rorippa sylvestris*, *Alliaria petiolata* and *Sisymbrium officinale ; polygoni* Thuem., on seedlings of *Polygonum convolvulus*, Hellington, 1943 ; *schachtii* Fckl., not uncommon on cultivated beet, including sugar beet ; *sordida* Berk., on *Scrophularia nodosa* at Arminghall, 1940 and on *Odontites rubra* at Tharston, Langley and Strumpshaw, 1942–43 ; *trifoliorum* de Bary, not uncommon on cultivated clovers and lucerne and found once on *Trifolium subterraneum* on Bradeston Hills, Brundall, 1944 ; *valerianae* Trail, fairly common on *Valeriana officinalis ; viciae*

(Berk.) Casp., common on cultivated peas, vetches and on *Lathyrus pratensis ; violacea* de Bary, on flowers of *Knautia arvensis* in one locality at Surlingham annually in July, from 1949 to 1956.

Pseudoperonospora humuli (M. & T.) Wilson, on *Humulus lupulus*, Surlingham.

Plasmopara densa (Rabenh.) Schroet., very common on *Rhinanthus minor* and seen occasionally on *Odontites rubra ; nivea* (Unger) Schroet., common on *Aegopodium podagraria, Angelica sylvestris, Anthriscus sylvestris* and *Peucedanum palustre ; pygmaea* (Unger) Schroet., on *Anemone nemorosa*, Cringleford, 1941 ; *viticola* (Berk. & Curt. ex de Bary) Berl. & de Toni, occasionally troublesome on vines.

Bremia lactucae Regel, very common on cultivated lettuces and on the groundsel, *Senecio vulgaris ;* seen also on *Hypochaeris radicata* at Brundall, 1945. This mildew attacks a great many Compositae in various parts of the world.

Albuginaceae (White Rusts) :—

Cystopus candidus (Pers. ex Chev.) Lév., common on cultivated cabbages, mustard and wallflowers ; seen in Norfolk also on cultivated *Arabis caucasica, Aubrieta deltoidea* and *Lunaria annua* and on *Sinapis arvensis, Coronopus squamatus, Capsella bursa-pastoris, Cardamine hirsuta, Erysimum cheiranthoides* and *Sisymbrium officinale ; cubicus* (Strauss ex Unger) Lév., fairly common on *Tragopogon pratensis* and its subspecies *minor ; lepigoni* de Bary, on *Spergularia marginata*, Scolt Head Island and Breydon Water.

ENTOMOGENOUS FUNGI IN NORFOLK.

By E. A. Ellis

About sixty kinds of fungi have been found growing on insects and arachnids in Norfolk (T. Petch : A Revised List of British Entomogenous Fungi, *Trans. Brit. Myc. Soc.* xxxi, 286–304, 1948). Seventeen of these are parasitic phycomycetes (Entomophthoraceae) occurring on mites, earwigs, aphids, leafhoppers, flies, caterpillars, beetles and sawflies ; nine are parasitic Ascomycetes of the family Hypocreaceae (species of *Cordyceps* and *Torrubiella*) attacking spiders, flies, moths and Hymenoptera ; the rest are parasitic and in some cases probably saprophytic Fungi Imperfecti grouped for temporary convenience in the Form Order Moniliales : they occur on spiders and a variety of insects and their larvae and pupae.

Entomogenous fungi abound chiefly in those parts of the world where the climate is warm and humid. Here in the British Isles they develop most freely in moist shady places, under trees and in the shelter of rank marsh vegetation. The carrs, fens and reed-swamps of the Norfolk Broads have so far proved the richest of all British habitats for them, having produced, since 1937, seven species new to science and fifteen other species not previously discovered in this country. Accounts of nearly all these local finds were published by T. Petch in a number of papers in the *Transactions of the British Mycological Society* up to 1948. The purpose of the present note is to place on record further information about some of the Norfolk species and to provide photographic illustrations not otherwise available as an aid to the recognition of these fungi in the field.

Entomophthora phalangicida Lagh. *Bih. K. Sv. Vet.-Akad. Handl.* Bd. xxiv. Afd. III, No. 4. 1899, p. 12, tab. III, fig. 1–7.

Dr. R. W. G. Dennis and I collected two female harvest spiders (*Phalangium opilio* L.) (photograph 1) killed by a fungus, on the upper surfaces of nettle leaves in Heron Carr, Irstead, August 7th, 1955. The fungus mycelium investing the bodies and proximal portions of the legs was of a light creamy brown colour and had a somewhat waxy appearance. On microscopic examination, the conidiophores were found to be commonly

about 10 μ thick ; only a few primary conidia were seen and those measured were 25 μ by 12.5 μ. Lagerheim described the primary conidia as measuring 19–22 μ by 10 μ. in his Swedish *E. phalangicida*, but since in all other respects the resemblance is clear, the Norfolk material is referred to this species, not hitherto recorded from Britain.

Entomophthora aphrophorae Rostrup

This fungus (photograph 2) attacks froghoppers and is responsible for killing off considerable numbers of the large alder froghopper, *Aphrophora spumaria* (L.) and the ubiquitous *Philaenus leucophthalmus* (L.) in the fens and carrs of East Norfolk from June to September. The insects are found attached to the under sides of living leaves of various bushes and tall marsh plants such as hemp agrimony, meadowsweet and yellow loosestrife.

Empusa acaridis Petch

This was described (Petch, 1944) from a single specimen on a mite, *Pergamasus crassipes* L. which I collected from a leaf of the grass *Glyceria maxima* on Home Marsh, Wheatfen Broad, Norfolk, August 9th, 1942. The type specimen has since been deposited at Kew. I found a second example on the same kind of mite in the type locality, September 4th, 1955.

Torrubiella albolanata Petch

Petch, 1944, described this fungus from specimens growing on the bodies of spiders in fen and reedswamp habitats at Wheatfen Broad in 1942 and 1943. The affected spiders may be distinguished before death by the appearance of a whitish bloom on their bodies ; later, a downy growth of white mycelium develops and conidia are produced (*Cylindrophora aranearum* Petch) (photograph 3, b.). In about four weeks, the *Torrubiella* perithecia mature in clusters (photograph 3, c and d) ; they are at first immersed in the downy mycelium, but ultimately their yellowish tips protrude. I have made upwards of ninety collections of this fungus regularly from May to October each year between 1942 and 1956 in the marshes at Wheatfen and elsewhere in East Norfolk. Additional localities for it in the Yare Valley include Surlingham Broad, Postwick, Brundall, Bradeston and Strumpshaw ; it is also present in fens at Buxton

Heath, Hevingham ; Crostwick Common, Southrepps Common, Swannington Upgate Common, Irstead (Heron Carr), Dilham Great Fen, Flegg Burgh Common, Hickling Broad, Billingford Common (Waveney Valley) and Somerleyton (Suffolk). This species has so far escaped notice outside East Anglia. In a few instances, the fungus has been found parasitising spiders' eggs (photograph 3, a).

Torrubiella aranicida Boud

The elongate, orange-coloured perithecia, seated on thin wefts of hyphae and scattered over all parts of the body and legs of the spider may be distinguished easily in the field from those of *T. albolanata*. The first Norfolk specimen was collected from a patch of the rush *Juncus acutiflorus* at Burntfen Broad, August 2nd, 1945 (photograph 3, e) (this was mistakenly recorded by Petch (1948) as having been found at Wheatfen Broad). I have since found it on two spiders on Middle Marsh, Wheatfen, September 10th, 1947.

Torrubiella albotomentosa Petch

Petch described this species in 1944 from material on a small dipterous pupa lodged in a stem of the grass *Glyceria maxima* at Wheatfen, May 30th, 1943. The perithecia were accompanied by conidia of *Cylindrophora* type. I have collected further specimens of the perithecia of this fungus as follows : on a newly dead reed-beetle, *Plateumaris braccata* (Scop.), Middle Marsh, Wheatfen Broad, August 1st, 1955 (photograph 4) ; on *P. braccata* and on a dipterous pupa in mixed reedswamp at Surlingham Broad, September 1st, 1955 and on a homopteron in sub-maritime fen at Horsey Warren, July 1st, 1956.

Cordyceps tuberculata (Lebert) Maire

The perithecial clubs of this fungus on moth pupae are generally smaller and more slender than those of the common *Cordyceps militaris* developing from buried pupae and mummified caterpillars. This fungus has only been recognised in this country on a few occasions and most of the specimens have been found under alders in fens and carrs of the Broads (photograph 5).

Cordyceps forquignoni Quél

I find this fungus regularly in the woods at Wheatfen, where it springs from the mummified bodies of flies among dead

leaves, usually under sycamore trees. The slender, whitish, conidial clubs (*Hymenostilbe muscaria* Petch) develop in autumn and winter and the more or less globose perithecial heads (photograph 6) mature in May and June. I have often seen flies of the species parasitised sucking up honey-dew from leaves on the ground under the sycamores where the fungus occurs and it appears likely that they become infected the more readily under such circumstances.

Isaria fumoso-rosea Wize

This is one of the most conspicuous of entomogenous fungi occurring in fens. It produces numerous slender conidial clavae ranging from pale dusky pink to orange pink in colour on the bodies of glow-worms (*Lampyris noctiluca* L.) (photograph 7) ; larvae of all sizes as well as adult females are parasitised, from June to November. I have found it on about forty occasions since 1937, at Wheatfen Broad, Strumpshaw and Brundall in the Yare Valley and at Alderfen Broad, Swannington Upgate Common and Flordon Common. Elsewhere in Britain, it has been noticed only on the Suffolk border, at Redgrave Fen and on the Blundeston marshes. One Wheatfen specimen is exceptional in that it developed on the cocoon-shrouded chrysalis of a round-winged muslin moth (*Comacla senex*), collected October 4th, 1942. Abroad, it has been recorded from pupae of cabbage flies, beetles and various lepidoptera. I have found very small immature yellow and reddish perithecia present on the clavae of specimens collected in autumn on several occasions ; these closely resemble the young perithecia of *Melanospora parasitica*, but I have seen no mature *Melanospora* on any of the specimens.

Isaria tenuipes Peck

This large, branching *Isaria* (photograph 8) may be distinguished from the common *I. farinosa* by its possession of a lemon yellow stalk and more feathery appearance ; also, it has oblong-ellipsoid or cylindrical spores 4 to 6 μ long. It has so far been noticed in this country only in damp woodland at Wheatfen Broad ; there it has appeared regularly from late August to October since October 15th, 1938, when it was first collected on buried moth pupae. Of the numerous specimens examined, nearly all have been growing from cocoon-covered pupae of

Notodontid moths in ground under sycamores ; these pupae closely resemble those of the Maple Prominent (*Lophopteryx cucullina* (Schiff.)). A few specimens of the fungus have been found parasitised by *Melanospora parasitica* (photograph 8, specimen on extreme left).

Gibellula aranearum (Schw.) Syd.

This is a common parasite of spiders in fens and meadows, from June to October. Many of the spiders are killed by it when they are still quite young. The slender clavae (photograph 9) are of a pale lilac or dusty pink colour at maturity and the basal mycelium investing the bodies of the spiders varies from white to light canary yellow. I have found this fungus in the following Norfolk localities : Old Lakenham, Wheatfen and Rockland Broads, Brundall, Bradeston, Strumpshaw (all in the Yare Valley) ; Burntfen and Upton Broads ; Honing, Barton, Irstead, Alderfen Broad ; Hickling Broad, Horsey Warren ; South Lopham, Aldeby, Haddiscoe ; Tharston, Mulbarton Common, Crostwick Common, Buxton Heath (Hevingham), Bryant's Heath (Felmingham) and once in a garden at Hellington. T. Petch found it at Holt House Wood, near King's Lynn, in 1931. *G. aranearum* has also been identified occasionally from insect hosts in the tropics, including locusts and leafhoppers ; all of my collections have been from spiders with the exception of specimens on small fly pupae and an immature froghopper at Swannington Upgate Common, July, 1944 and on a cluster of Braconid cocoons attached to a meadowsweet leaf at Redgrave Fen, August, 1947.

Cylindrodendrum suffultum Petch

This species (photograph 10) was described by Petch in 1944 from material collected on fly pupae (Psychodidae and Tipulidae) in marshes at Trowse and in fens at Wheatfen Broad, Surlingham. On the smaller pupae, it produces little powdery white tufts at either end, but on those of Tipulidae and some Stratiomyidae *Isaria*-like clubs are often produced. I have found *C. suffultum* commonly from May to November in the wetter parts of fens in East Norfolk ; it is often abundant in the old leaf-mats of *Glyceria maxima* in the Yare Valley and some of the larger isarioid specimens have appeared in sub-maritime fens

of the Lower Waveney and at Horsey. The specimens photographed have been chosen to show the wide range of development in this fungus, which has not been figured previously.

Hirsutella citriformis Speare

I came upon this fungus parasitising large numbers of Homoptera clinging to leaves of sedges and other marsh plants near the River Yare at Postwick, October 18th and 28th, 1945 (photograph 11). The hosts included *Kelisia scottii* (Fieb.) and *Areopus pulchellus* Curt. One specimen was on an assassin bug, *Nabis lineatus* Dahlb. T. Petch informed me that he had not previously seen this except from the tropics.

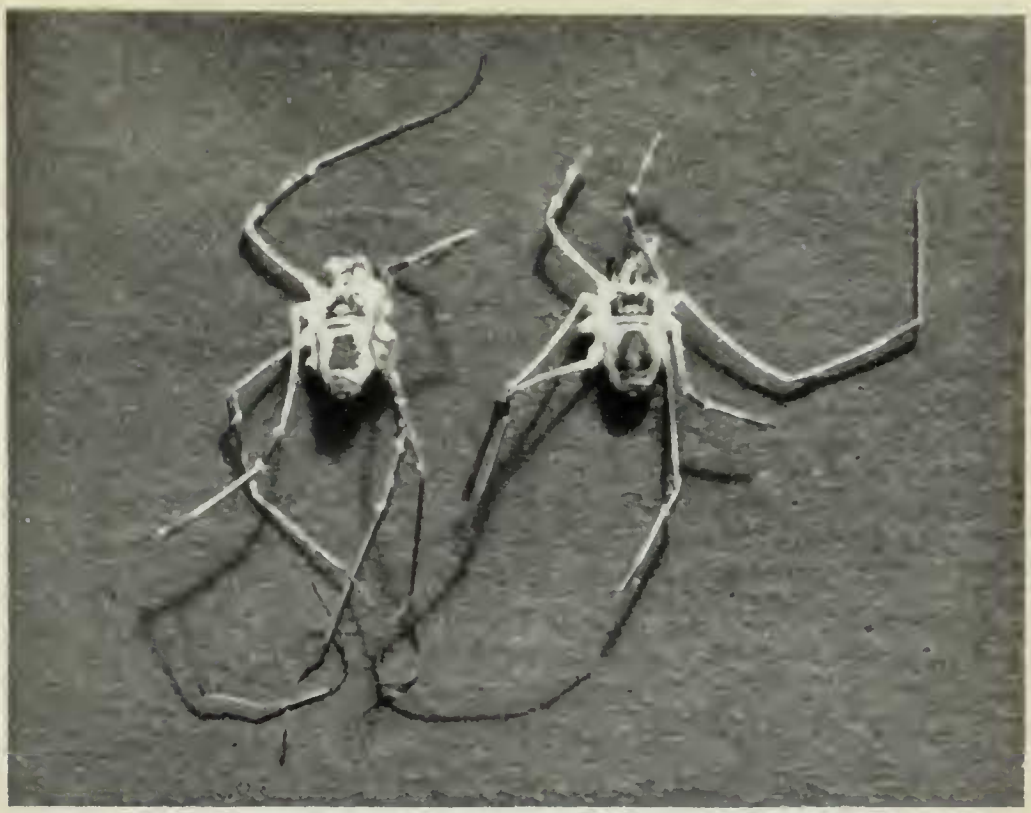
Spicaria prasina (Maubl.) Saw.

Caterpillars of various sizes may be found dead and covered with a powdery white felt of this fungus (photograph 12) in grassy places, chiefly round the edges of fens. Ultimately, the conidiophores become pale green. Norfolk localities include Wheatfen Broad, the Bradeston Hills, Cringleford Marshes, Hoe Common (specimen from K. C. Durrant, August 22nd, 1954), Brinton (specimen from R. P. Bagnall Oakeley, September, 1954), Crostwick Common and Roydon Fen near Diss.

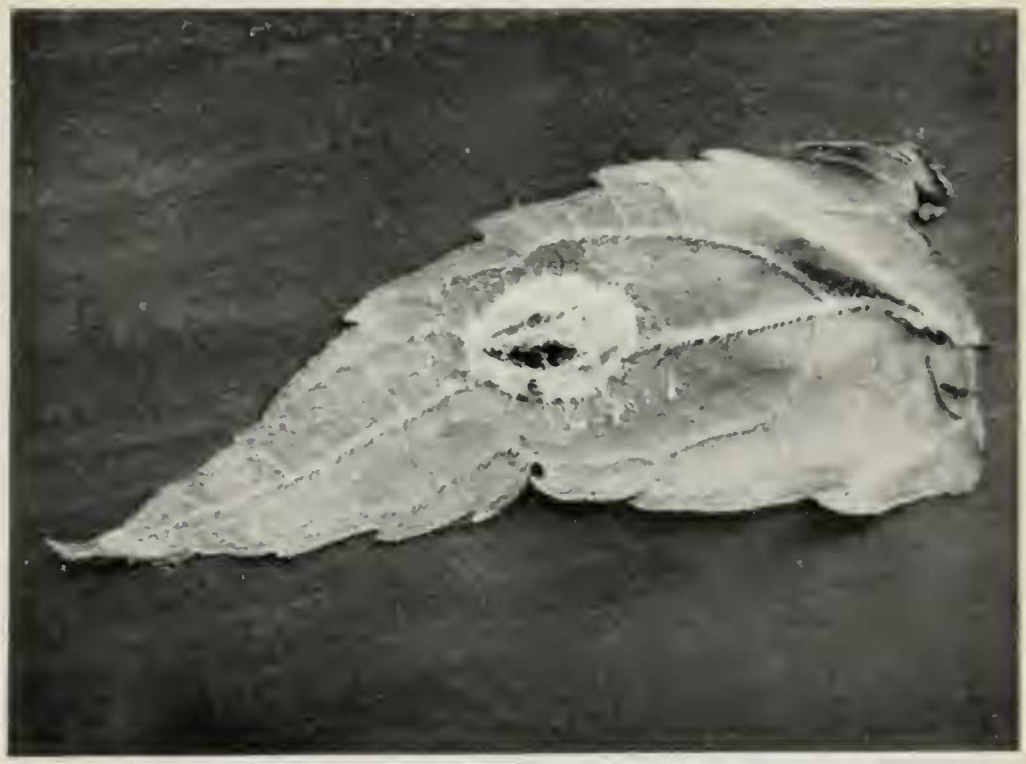
Note added September, 1956.

Since the above was written, I have succeeded in finding *Torrubiella albolanata* Petch on spiders in West Norfolk (Litcham Common and the Nar Valley at Westacre, 29.8.1956) and outside Norfolk (Cothill Fen, Berkshire, 14.8.1956 and Flitwick Moor, Bedfordshire, 25.8.1956). *Spicaria prasina* (Maubl.) Saw. which had escaped notice in Europe until 1939, when it turned up at Wheatfen, is more widely distributed in this country than has been suspected ; I found it on caterpillars at Pixey Mead, by the Thames at Godstow, Oxfordshire, 15.8.1956 ; in a fen habitat at Flitwick Moor, Bedfordshire, 26.8.1956 and at Litcham Common in West Norfolk, 29.8.1956.

I am greatly indebted to Mr. Hallam Ashley for taking all but two of the photographs illustrating this paper; photographs 2 and 8 are typical examples of the beautiful work of our member, Mr. H. J. Howard.



PHOTOGRAPH 1. *Entomophthora phalangicida* Lagh. on *Phalangium opilio* L., Irstead, Norfolk, 7.8.1955.

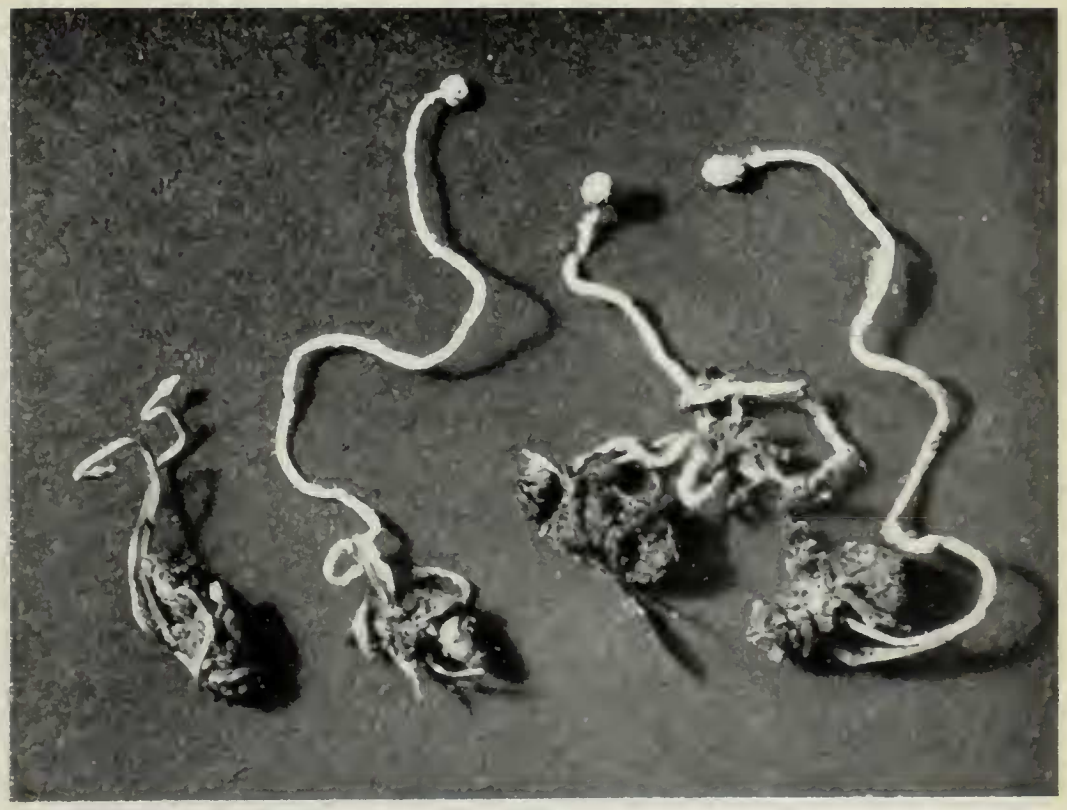


PHOTOGRAPH 2. *Entomophthora aphrophorae* Rostr. on *Aphrophora spumaria* (L.), Wheatfen, Norfolk, 11.7.1943.

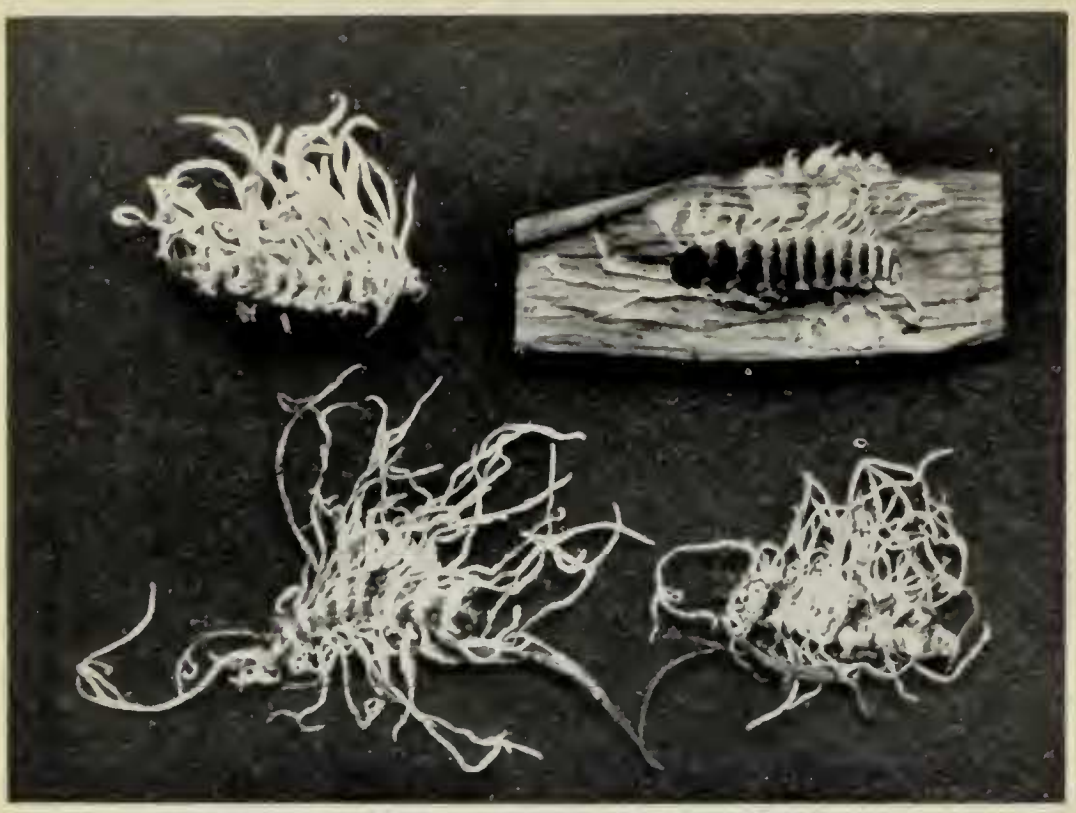
PHOTOGRAPH 3. *Torrubiella albolanata* Petch.
(a) on a spider's egg-cocoon, Wheatfen, 10.8.1955.
(b) on a spider, Wheatfen, 10.8.1955 (conidial).
(c) on a spider, Heron Carr, Irstead, 7.8.1955.
(d) on a spider, Crostwick Common, 9.8.1955.
(e) *Torrubiella aranicida* Boud., Burntfen Broad, 2.8.1945.

PHOTOGRAPH 4. *Torrubiella albotomentosa* Petch on *Plateumaris braccata* (Scop.), Wheatfen, 1.8.1955.

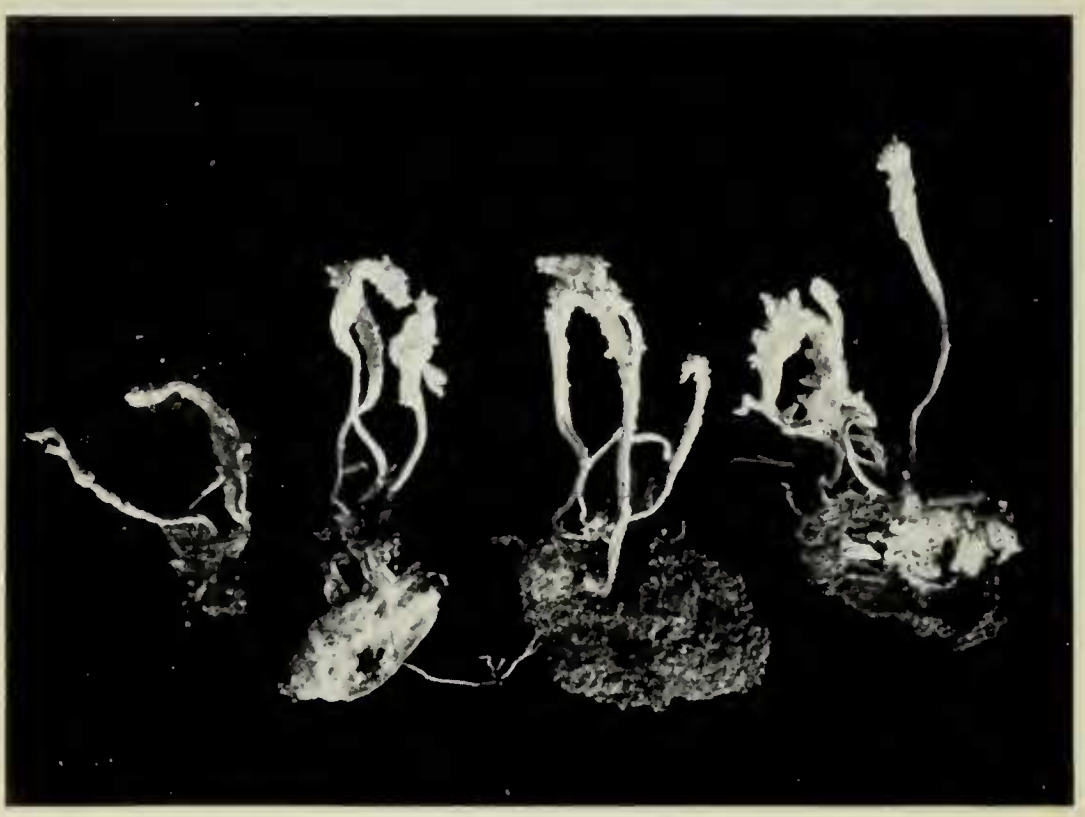
PHOTOGRAPH 5. *Cordyceps tuberculata* (Lebert) Maire.
(a) Low Common, Hellington, 9.5.1943.
(b) Alderfen Broad, 19.8.1945.
(c) and (d) Brundall Marshes, 16.8.1945.
All on small lepidopterous pupae under alders.



PHOTOGRAPH 6. *Cordyceps forquignoni* Quél.
(a) immature perithecial club, Wheatfen, 26.3.1942.
(b), (c) and (d) with mature perithecia, Wheatfen, 18.6.1946.
All on dead flies under sycamores.



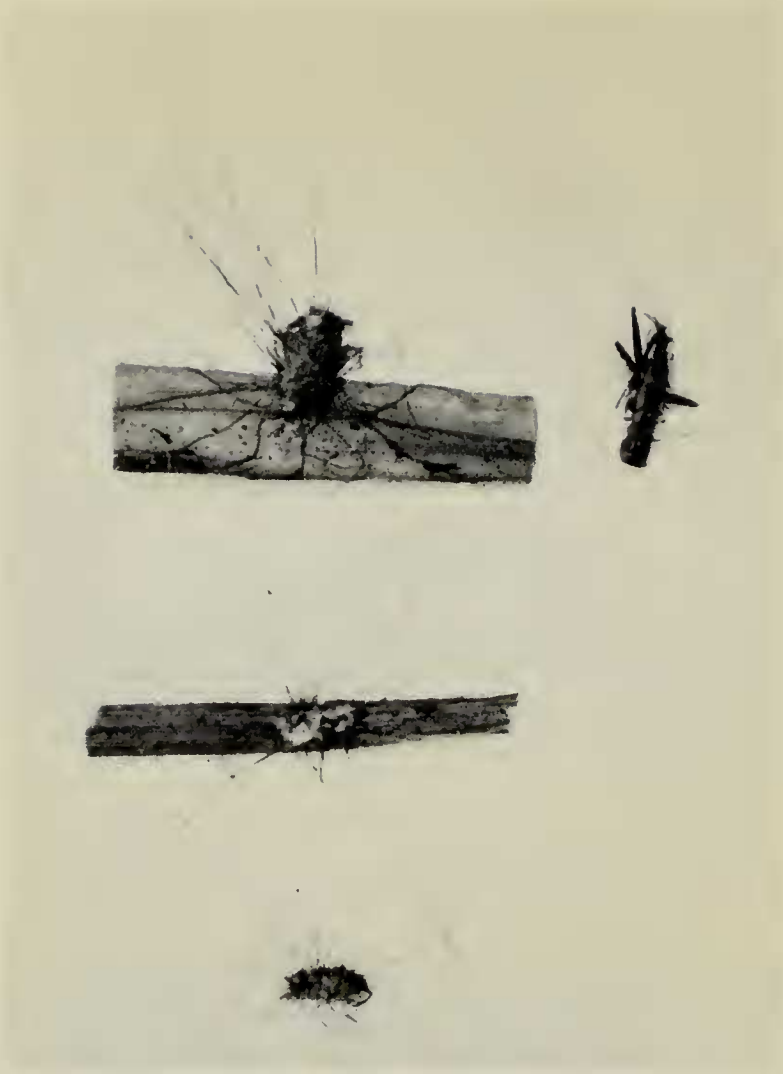
PHOTOGRAPH 7. *Isaria fumoso-rosea* Wize.
(a) Flordon Common, 8.1952.
(b) Blundeston Marshes, Suffolk, 4.9.1943.
(c) Alderfen Broad, 19.8.1945.
(d) Wheatfen, 15.10.1944.
All on dead glow-worms, *Lampyris noctiluca* L.



PHOTOGRAPH 8. *Isaria tenuipes* Peck on lepidopterous pupae, Wheatfen, 20.9.1942. The specimen on extreme left is parasitised by *Melanospora parasitica* Tul.

PHOTOGRAPH 9. *Cibellula arancarum* (Schw.) Syd. on spiders. (a), (b), (c) and (d), Wheatfen, 10.8.1955. (e) Heron Carr, Irstead, 7.8.1955.

PHOTOGRAPH 10. *Cylindrodendrum suffultum* Petch on dipterous pupae. The four large specimens on the left are from St. Olave's, Suffolk, 18.7.1944 ; the upper three on right from Wheatfen, 19.6.1943 ; others, Wheatfen, 2.9.1943.



PHOTOGRAPH 11. *Hirsutella citriformis* Speare.
(a) on *Aracopus pulchellus* (Curtis).
(b) on *Nabis lineatus* Dahlb. (c, d) on Homoptera.
All from Postwick, Norfolk, 10.1945.

PHOTOGRAPH 12. *Spicaria prasina* (Maubl.) Saw. on caterpillars, Crostwick Common, 9.8.1955.

Back Numbers of the Transactions available for Sale to Members

1871–72	Vol. I	pt. 3	...	1/6
1872–73	Vol. I	pt. 4	...	1/6
1879–80	Vol. III	pt. 1	...	1/–
1880–81	Vol. III	pt. 2	...	1/–
1881–82	Vol. III	pt. 3	...	1/6
1882–83	Vol. III	pt. 4	...	1/6
1883–84	Vol. III	pt. 5	...	2/6
1884–85	Vol. IV	pt. 1	...	1/–
1886–87	Vol. IV	pt. 3	...	1/–
1888–89	Vol. IV	pt. 5	...	2/–
1890–91	Vol. V	pt. 2	...	1/–
1891–92	Vol. V	pt. 3	...	1/–
1892–93	Vol. V	pt. 4	...	1/6
1893–94	Vol. V	pt. 5	...	2/6
1894–95	Vol. VI	pt. 1	...	1/6
1895–96	Vol. VI	pt. 2	...	1/6
1896–97	Vol. VI	pt. 3	...	1/6
1899–00	Vol. VII	pt. 1	...	1/6
1901–02	Vol. VII	pt. 3	...	2/–
1902–03	Vol. VII	pt. 4	...	2/6
1903–04	Vol. VII	pt. 5	...	2/6
1906–07	Vol. VIII	pt. 3	...	2/–
1911–12	Vol. IX	pt. 3	...	2/–
1913–14	Vol. IX	pt. 5	...	1/–
1914–15	Vol. X	pt. 1	...	2/6
1915–16	Vol. X	pt. 2	...	2/–
1916–17	Vol. X	pt. 3	...	1/6
1917–18	Vol. X	pt. 4	...	1/–
1918–19	Vol. X	pt. 5	...	1/–
1919–20	Vol. XI	pt. 1	...	2/6
1920–21	Vol. XI	pt. 2	...	1/6
1921–22	Vol. XI	pt. 3	...	1/6
1922–23	Vol. XI	pt. 4	...	1/6
1923–24	Vol. XI	pt. 5	...	1/6
1924–25	Vol. XII	pt. 1	...	2/–
1926–27	Vol. XII	pt. 3	...	1/6
1927–28	Vol. XII	pt. 4	...	1/6
1928–29	Vol. XII	pt. 5	...	1/6
1929–30	Vol. XIII	pt. 1	...	2/–
1930–31	Vol. XIII	pt. 2	...	1/–
1931–32	Vol. XIII	pt. 3	...	2/6
	" East Anglian Flora."			
1932–33	Vol. XIII	pt. 4	...	1/–
1933–34	Vol. XIII	pt. 5	...	1/–
1935	Vol. XIV	pt. 1	...	1/–
1936	Vol. XIV	pt. 2	...	1/–
1937	Vol. XIV	pt. 3	...	1/–
1938	Vol. XIV	pt. 4	...	1/–
1939	Vol. XV	pt. 1	...	1/6
1940	Vol. XV	pt. 2	...	1/–
1941	Vol. XV	pt. 3	...	1/–
1942	Vol. XV	pt. 4	...	1/–
1943	Vol. XV	pt. 5	...	1/–
1944	Vol. XVI	pt. 1	...	1/–
1945	Vol. XVI	pt. 2	...	1/–
1946	Vol. XVI	pt. 3	...	1/–
1947	Vol. XVI	pt. 4	...	1/6
1948	Vol. XVI	pt. 5	...	1/–
1949	Vol. XVII	pt. 1	...	1/–
1950	Vol. XVII	pt. 2	...	
	Out of print.			
1951	Vol. XVII	pt. 3	...	2/6
1952	Vol. XVII	pt. 4	...	5/–
1953	Vol. XVII	pt. 5	...	5/–
1953	Vol. XVII	Supplement		5/–
	Bird Report.			
1954	Vol. XVIII	pt. 1	...	3/6
	Plant List.			
1954	Vol. XVIII	pt. 2	...	
	Out of print.			
1955	Vol. XVIII	pt. 4	...	5/–
	Bird Report.			
1955	Vol. XVIII	pt. 3	...	5/–
	Norfolk Mycology.			

Copies of the Transactions, as listed above, can be obtained from the Assistant Secretary, Castle Museum, Norwich. Cheques should be made payable to the Society, postage 6d. extra each copy, should be allowed. Reduction in price will be made to any member purchasing ten or more parts. A list of some of the more important papers contained in the parts offered for sale can be had on application to the Assistant Secretary.

Norfolk & Norwich Naturalists' Society

Patron :

HER MAJESTY THE QUEEN.

President : 1956–57 : E. L. SWANN.

Hon. Secretary : F. J. TAYLOR PAGE, 77, Surrey Street, Norwich.

Hon. Assistant Secretary : MISS R. M. BARNES, Castle Museum, Norwich.

Hon. Treasurer : E. T. DANIELS, 352, Dereham Road, Norwich.

MEMBERSHIP.

A candidate for membership may be proposed and elected at any meeting of the Society. The rates of subscription are : for an Ordinary Member, 15/– ; for a Family, 25/– ; and for a School Group of six pupils, 2 guineas. Forms of application may be obtained from the Secretary. Subscriptions become due annually on 1st April.

PUBLICATIONS.

Papers on Norfolk Natural History intended for publication in the *Transactions* should be sent to the Hon. Editor, E. A. Ellis, Wheatfen Broad, Surlingham, Norwich, and should be typewritten. When convenient, the longer papers on related subjects will be published together in special Parts from time to time ; in addition, members are invited to contribute as many short papers and notes as possible for publication as a Miscellany. Contributions for the *Norfolk Bird Report* should be sent as soon as possible after 31st December each year to M. J. Seago, 33, Acacia Road, Thorpe, Norwich.