<u>"BALLISTIC" FUNGI</u>

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PART 2. Other Ballistic Fungi

While *Sphaerobolus stellatus* (Basidiomycete) (see Part 1 in previous Newsletter) is perhaps the "Big Gun" for active fungal spore dispersal , lobbing its sporangium up to 2 metres high and 5.5 metres distant, other fungi have evolved similar mechanisms for the active dispersal of their spore masses. Many of them are dung-inhabiting or coprophilous fungi, such as, *Ascobolus, Saccobolus, Podospora* (Ascomycete) and *Pilobolus* (Zygomycete) which to complete their life cycle need to disperse their spores onto the surrounding vegetation that, when eaten by herbivores and stimulated to germinate within their gut, then voided with the faeces, to begin a new vegetative phase of growth on the dung.

Of the succession of fungal genera that colonise herbivore dung *Pilobolus* (the hat thrower) of the order *Mucorales*, is commonly the first to sporulate. Incubation of fresh horse dung in a closed glass container, in the light and under humid conditions for about 3-4 days will provide an ample supply of the elegant glassy sporangiophores.

The *Pilobolus* sporangial structure consists of a swollen base, the trophocyst, (not noticeable as it is usually below the substrate surface) from which the slender sporangiophore arises, at the end of which there is an inflated sub-sporangial vesicle, on which sits an apical flattened, black-coloured sporangium. The height of the mature sporangiophore is 4 - 5 mm, with the sporangium having a diameter of 1.5 - 2 mm. (Fig.1)

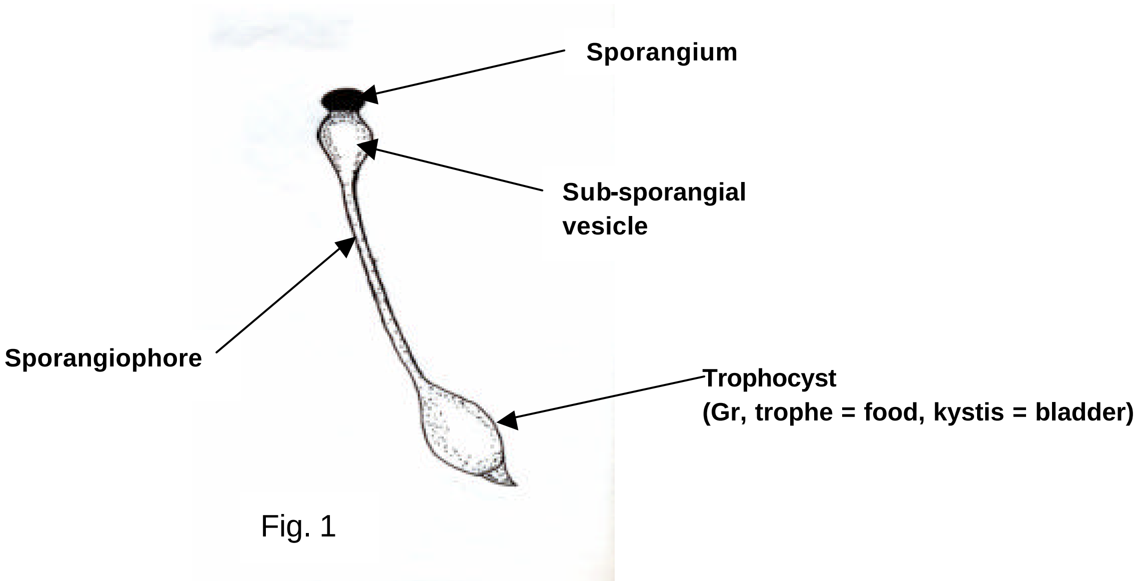

Fig. 1

The sporangiophore grows towards the light (positively phototropic) and while the mechanism is not yet clear, it is suggested that the sub-sporangial vesicle acts as a lens concentrating the incoming light on a light sensitive area at the base of the vesicle and this stimulates the flavanoids within the vesicle to promote the differential growth of the wall of the vesicle resulting in the sporangiophore bending towards the light. This process ensures that the sporangium is dispersed away from the dung. (Fig. 2)

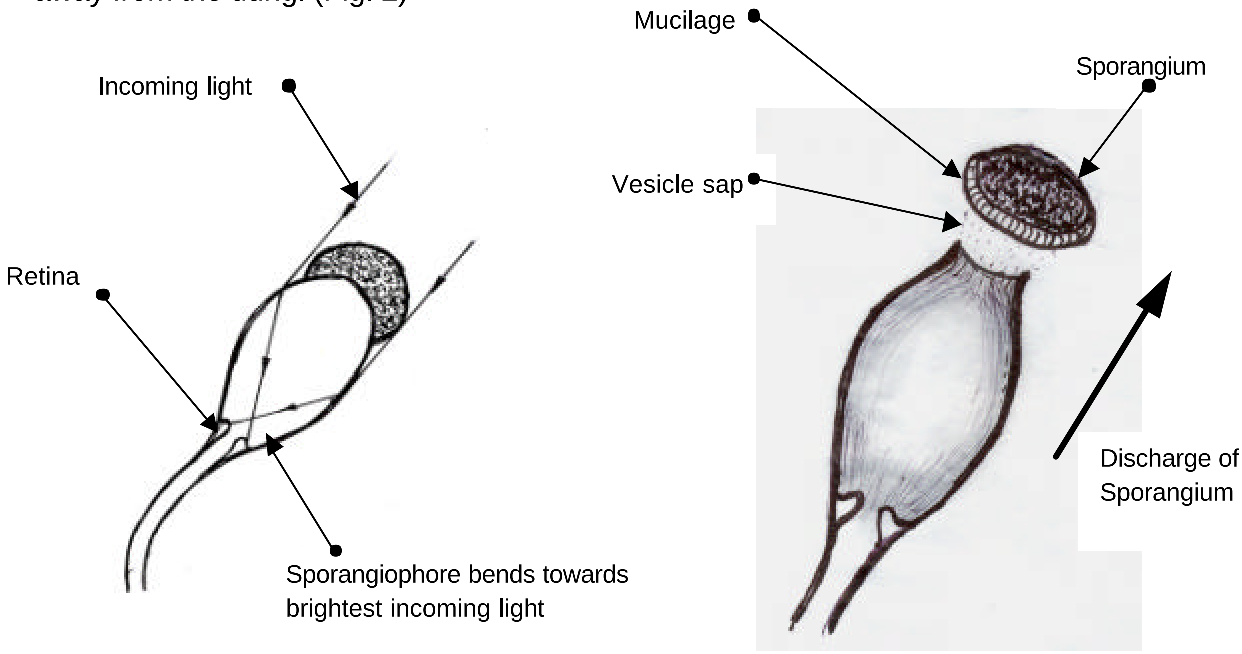

Fig. 2.

The dispersal mechanism is remarkable; osmotically active compounds cause pressure in the sporangiophore and the subsporangial vesicle to increase, until it is quite high (about 7 kilograms per square centimetre), resulting from this high turgor pressure the top of the sub-sporangial vesicle ruptures. The elasticity of the walls confining the contents to form a relatively high-velocity jet that can propel the sporangium vertically upwards to a height of about 2 metres. The sporangium has at the base a ring of mucilage that ensures it sticks firmly to any surface it hits. (Fig. 2)

While there are about 25 genera recorded as sporulating on incubated herbivore dung, the Ascomycete fungi with 12 genera are the most numerous of all the genera, appearing after about 7 days. The ascospores may be ejected either through the bursting of the ascus (usually positively phototropic) at the top, through a pore or slit, or cap-like operculum hinged at one end. Large numbers of ascospores are liberated simultaneously. Air moisture content, temperature, light and air currents are some of the many factors responsible for ascospore release. Each mature ascus is a single cell, surrounded by a cell wall stretched by the hydrostatic pressure within. The ascospores are suspended in a fluid within and when the turgid ascus bursts the wall contracts and the spores are ejected into the air.

Since ascomycetes are relatively low growing, the larger the distance of discharge provided to ascospores greatly enhances their chances of reaching the turbulent layer of air in the atmosphere or adjacent vegetation, where they stand a good chance of wide dispersal.

Active/passive mechanisms for dispersing spore masses can be observed in dung-inhabiting fungi such as found in the Pezizomycetes e.g. *Ascobolus* where the fruitbody is an apothecium (cup-shaped with an exposed layer of asci (hymenium). Each ascus contain 8 ascospores in a row, these are shot off a small distance; 10 -20 cm, and are then carried off by the wind either to other sources of dung or possibly to stick to grass that is ingested by herbivores

The Sordariomycetes (e.g. *Sordaria*) of the Ascomycota; have a fruit body that is a perithecium (a more or less closed flask shaped ascocarp, that at maturity has a pore (ostiole) through which the ascospores, contained within, are discharged) the neck of which is positively phototropic. Fig. 3.

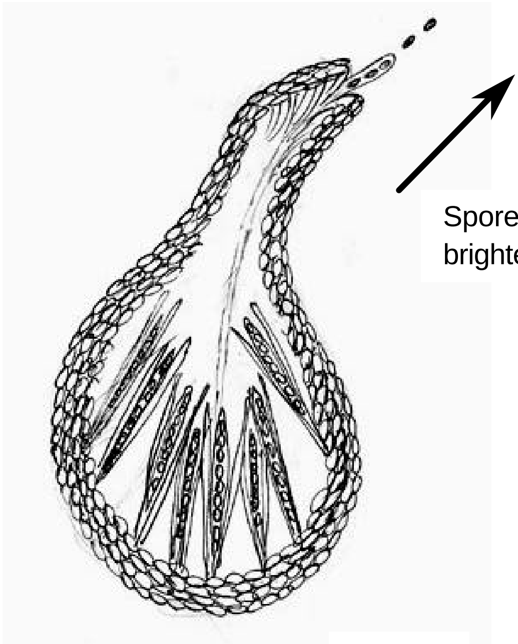

Fig. 3.

The maturing asci within the perithecium swell, filling the upper volume until one of the asci stretches and pushes through the ostiole, the base remaining attached to the perithecial wall. As the tip of the ascus emerges, all the spores are discharged explosively, guided by the phototropic perithecial neck towards the brightest local light, the ascus then collapses, disintegrates and the process is followed by the other asci.

The ballistic method of spore dispersal is likely an adaptation to the coprophilous habit and seems to have evolved many times independently during evolution.hile gravity is perhaps the initial means of fungal spore dispersal for many fungi, volutionary adaptations have been required of some fungal genera to overcome gravitational effects and to achieve their habitat requirements with an effective ballistic method of spore dispersal.