Summer in Somerset; a warm, lazy caricature of an English August afternoon with the bumble bees lolloping about the rose bushes, a fine mist of gnats over the sticky leafed azaleas and a wasp hovering long-legged over the strawberry jam.

Adrian Slack, looking like a cross between James Robertson Justice and Patrick Moore is ensconced on his terrace. He has been talking since mid-morning, pausing only to refill his wine glass. Slack is totally in his element. He is an outrageous anglophile and the day is completely to his liking. The wine is French, he has an attentive audience and the table is loaded down with the strange objects of his obsession – carnivorous plants.

But the closer you examine the scene the more bizarre it becomes. Days like this do not happen in England very often, it is as if Adrian has conjured it from romantic memory. Eccentrics like Slack, complete with cream linen suit and Panama hat, come from that same romantic past. And there he sits, a committed vegetarian all his life, completely seduced by plants that eat flesh.

Therein lies Adrian Slack’s considerable drawing power. He is an anachronism – a throwback to the great era of English naturalists when cultured men with small goatee beards patrolled the English countryside with picnic hampers and butterfly nets.

It is a carefully constructed and quite deliberate image. He lives and works in a remote part of south-west England where it is perfectly possible to believe that time has stood still since Edwardian days. Indeed,
Ancient Marston Mill in Somerset where Slack manages to grow tropical pitcher plants.

apart from a few details, such as the shape of the tractors and the TV aerials, it might well have done.

Until we stepped through his time door, Slack had deliberately avoided serious movement outside his Somerset frame of reference. His home is there; his greenhouses are a few miles away; his social life is shared with friends of like persuasions. He runs his own supper club in a pub several centuries old and the only partially political group he has ever joined is one that periodically refights the English civil war.

He is, however, a founder member of the British Carnivorous Plant Society, an organization he helped to create, and he did, in 1980, produce the best and most authoritative textbook on carnivorous plants yet to be published in English. That much of him is completely real even if it is a little unreal that he should have managed to pick up all that expertise on his own: he is both ‘untaught’ and ‘unqualified’ in any formal sense. He describes himself as a ‘plantsman’.

He would like to be seen as a kind of midEdwardian Gilbert White, on the botanical side of the family. In fact, he is rather better than that. He does not need to be a caricature: his love and knowledge of carnivorous plants make him an original. If he epitomizes anything it is the committed amateur naturalist whose enthusiasm eventually ranks him, or her, with the most qualified professional natural history scientist.

The study of natural history was a tradition spawned in Britain, and later taken up with alacrity by underemployed English priests (Gilbert White was the vicar of Selbourne) and genteel women who were also rather short of things to do. There are few words in the language quite so evocatively English as ‘naturalist’.

We should, therefore, have been less surprised when the offer of a trip to the New World, there to visit a carnivorous plant Eden called the Okefenoke swamp, was not at first greeted with the enthusiasm we felt it deserved. We did not know that Slack had never been outside England and to leave its shores would, like a chameleon in space, involve him dropping some of his highly protective colouring. But the idea eventually grew on him (had not Burton entered Mecca and Darwin the Galapagos?). The man is the most industrious talker we have ever met, but for a moment the ‘American difference’ took his
breath away. He is the most gregarious individual we came across, hunting receptive listeners like bees seek honey, but for half a day American friendliness rendered him positively shy. Fortunately, the sights, smells and plant life of the extraordinary Okeefenoke swamp, otherwise known as the ‘Land of the Trembling Earth’, cleared the American log jam and the words began to flow again.

We went in at dawn, poling through channels of dark peat water between tangled screens of swamp plants. Slash pine, known locally as turpentine trees, stick up out of the water, their tops hung with ghostly wraps of Spanish moss. As the sun rose, huge cobwebs spun from fine strands of copper glistened across the ‘hoorah bushes’. Once the Okeefenoke was a centre for moonshine whisky production in the South and when the ‘revenuers’ made their raids, the stills would be hidden in the swamp bushes. Relieved moonshiners would mutter ‘hoorah’ from the thickets as the revenuers passed by – or so the locals would have us believe.

The Okeefenoke is technically as close to Eden as you can get on our planet, one of the few remaining echoes of the kind of conditions in which life on earth was developed. There is plenty of water; it is warm to hot all the year round; there is perfect cover.

Small wonder that the Okeefenoke National Wildlife Refuge boasts at least 200 species of woody plants, most in great abundance. Many of these are exotic and present a spectacular display almost all the year round.

Feeding on these rich growths, and on each other, are a mass of animals. At the last count there were some 18,000 alligators in the swamp, numerous species of snakes, black bear, a host of small mammals and literally millions of insects.

Slack in his element, a warm English day, a glass of wine, and a crowd of carnivorous plants.
And there is the Okeefenoke’s unique collection of indigenous plants that have one foot, or root, in both the animal and the plant kingdom – the plants of prey.

By this time, with the dawn yellowing all around us, Adrian was almost incoherent with excitement. Rather than having to search for the pinguiculas, sarracenias and droseras, they were everywhere. It started as we approached the park gates in the first light. Slack spotted something from the car and we were commanded to stop. We found him with damp knees beside the road. There in a line alongside the tarmac were bladderworts that absorb animal protein through bladder traps on their roots, miniature trumpets that attract insects with nectar then lure them to their death, and very tiny sundews that threaten the insects of the microuniverse with a sticky end. Only the prospect of giant versions of these vegetable predators growing wild on the floating islands in the Okeefenoke, eventually lured Adrian back to the car.

In the swamp itself, it was Adrian who spotted the first clump of hooded pitchers with a shout of alarm: ‘Good God! That shouldn’t be there at all.’ The object of his amazement was some three feet tall, sallow green, and rising to a reddish-speckled hood, like a rearing snake. There were several of them and they looked ominous.

There is, in fact, no good reason whatsoever for humans to be even marginally afraid of carnivorous plants, but there is no denying that they have ‘monster’ appeal, simply
because they do live on meat. Their food is one of the smaller forms of animal protein— insects—but it is flesh and blood none the less. This ‘flesh-eating’ ability also gives the carnivorous plants a special status in the human mind. Normally we see plants as part of another world; they are not even remotely related to us, and their lifestyles and life-processes are alien to animals. They do not have hands, lungs, mouths or stomachs and they cannot move about.

Except for the carnivorous plants. Venus’s fly traps have clawed extensions with spines that ‘grab’ their prey much as we would catch a butterfly. Yellow, hooded and parrot pitchers have openings very like mouths leading
In the Okeefenoke swamp, bladderworts abound, floating about in search of prey.

down into chambers where their meals are digested in a not un-human way. Butterworts – looking like small green starfish – can move: their leaves curl inwards over their prey. And in the Okeefenoke some of the bladderworts can move long distances: they have evolved a raft on which they drift about, trailing their traps in the water to catch aquatic insects.

It is almost as if this is a branch of the plant kingdom that is creeping up on us, even though that impression is botanical nonsense. The existence in nature of plants that are more than inanimate vegetables – 'that actually got into motion and grasped their prey in no uncertain way' – was the factor which launched Slack, as a very young boy, into a hobby destined to become his life's work.

The hooded pitcher plant (*Sarracenia major*) is one of the worst offenders. Its snake-like hood, protecting a honey-coated throat and a maze trap, does look predatory. Even though Adrian Slack has been interested in carnivorous plants for more than 20 years he still admits to a degree of anthropomorphism. 'I do look upon them almost as animals, which of course they are not.' He nodded in the direction of the offending Okeefenoke hooded pitcher. 'Just look at it. It's very hard not to think of it as a sort of meditating monk.'
water colour of a plant with round leaves, red tentacles and glistening dew drops on the tentacles. ‘I wanted to get that plant’, Slack remembers. ‘They said it grew in bogs and I went all over Herefordshire looking in any place that was moist. I went up the hills and even into the woods, but alas, the mission was hopeless. Year after year went past and still I looked for that plant. I didn’t actually find it until I was 18.’ The plant was the common round-leaved sundew, and by this time Slack was laying the foundations of a career as a landscape gardener.

‘Having got one, of course, I wanted to grow it. The first time I tried I failed to grow one, but I managed the second and that was the beginning of my collection, although, of course, I didn’t realize it at the time.’

He badly wanted some of the more exotic American carnivorous plants and eventually acquired them – albeit somewhat illegally. ‘A kind person came over on the Queen Mary and brought me, illicitly in a sponge bag, a whole lot of plants; in particular my first Venus’s fly traps.’ The Venus’s fly trap (Dionaea muscipula), although only a few inches high, is certainly the most impressive performer of the carnivorous plants. It grows ‘claws’ more than an inch long. Adrian Slack studied his illegal immigrant with a sense of wonder that he still feels today. But then a
Contrary to legend no carnivorous plant, even a clump of Venus’s fly traps, is in any way dangerous, other than to insects.

Venus’s fly trap does have extraordinary abilities.

It attracts flies and other insects by its coloration – the insides of the traps are a pretty coral pink deepening to red – and by producing nectar. Inside each trap are fine hair-like triggers which, when activated, cause the trap to close on its prey. But the mechanism is complex. First, a trigger will not activate the plant unless it is touched twice within about 20 seconds, or two separate hairs are touched once within the same period! In Slack’s opinion this double trigger is an energy-saver and a selection mechanism. ‘If you’re an insect and have settled in the open trap and are walking about eating your nectar, you are bound to touch a trigger twice eventually. But the plant doesn’t want to be shutting on every bit of wind-blown matter that hits a trigger in passing.’

And double-trigger selection is only stage one of the Venus’s fly trap’s very picky nature: the traps do not close up tight straight away, rather the spines fringing the two faces of the trap close to form a grill. ‘If the triggers have been set off by a very tiny creature of no use to the plant it can, in the next 20 minutes, crawl through the loose grill between the bristles. In this event, after 20 minutes the leaf will start gradually to open again. On the other hand if the insect is substantial – too big to get through the bristle grill – the leaf will start to close in on it, pressing it to death, and will then remain absolutely closed until the creature has been fully digested.’

Adrian Slack, like everyone who has ever seen a Venus’s fly trap in action, wondered how a plant which has no nervous system and no brain could operate such elaborate mechanisms. In fact, by careful experiment he has found that Venus’s fly traps are selective chemically as well as mechanically.

If a piece of wood or a stone sets off the trap and the fragment is too big to fall through the bristle grill, the plant will close down on it. But when it fails to get what Slack terms a ‘nitrogenous signal’ from the crushed object, the plant does not produce digestive acids and enzymes and will, after about 24 hours, open again. Slack proved that the Venus’s fly trap actually conducts a chemical analysis of trapped items. ‘If you put some meat extract on the stone, you find that all the digestive processes begin.’

But even though he has been gazing at
Venus’s fly traps with wonder and through microscopes for two decades, he still has no idea what causes the reactive processes of this extraordinary plant. He suspects the impulse messages which cause both a build up and a loss of turgidity in cells along the spines of the trap lobe are electrical.

Now hopelessly seduced by the exotic contents of the Queen Mary sponge bag, Slack became a serious collector and the landscape gardening assumed second place. To understand how carnivorous plants had evolved, he needed a great many species and his collection soon became very unwieldy. ‘I went up to Cumberland for three years, and the Bishop of Penrith had a lot of mouldering greenhouses which he allowed me to do up and take over. Eventually there were hundreds of plants. Some of them had to go outside; I was surprised to find that some survived this, but in the end I was throwing them out by the handful. We had huge funeral pyres in the garden: it was pathetic.

‘At a dinner party I was telling a friend of mine how depressed I was after burning plants all day and he said “Why don’t you sell them?” ’ Thus began one of the most successful cottage industries in contemporary Britain and a perfect solution for Adrian Slack. The Somerset greenhouses and the unwieldy collection were now financed by mail order sales to an ever-expanding public. It also meant that Slack could play with his plants, hybridize them and breed selectively.

But to do that he had to learn all there was to know about the many different types of insect-catchng plants, and how they worked. There are 14 different genera of carnivorous plants, best classified according to their method of trapping prey, which is either active or, more commonly, passive.

The passive trappers can further be divided into three groups according to the type of trap employed. For example, ‘pitfall’ traps are characteristic of all five genera of pitcher plants – sun pitchers (Heliamphora), trumpet pitchers (Sarracenia), cobra lilies (Darlingtonia), tropical pitcher plants (Nepenthes) and the West Australian pitcher plant (Cephalotus). The ‘lobster pot’ variety, which involves a one-way portal, is employed by one of the sarracenias, the parrot pitcher (Sarracenia psittacina) and a unique water plant,
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*Genlisia,* of the bladderwort/butterwort family. The third variety of passive trap operates like a sticky flypaper and is used by two genera, the rainbow plant (*Byblis*) and the Portuguese sundew (*Drosophyllum*).

Active traps are employed by seven genera and can be divided into three types. The first has added a twist — literally — to the sticky flytrap: the sundews (*Drosera*) of which there are more than 90 species, have evolved minute tentacles which curl round their prey. Similarly, the butterworts (*Pinguicula*) can curl the tips of their sticky leaves round a trapped insect. The remaining two mechanisms are the 'steel traps' and the 'mouse traps'. The Venus's fly trap is the best example of the former; it shares the method with another genus, the waterwheel plant (*Aldrovanda*), which has a tiny trap of only 2 mm that operates underwater. Mouse traps are used by the bladderworts (*Utricularia*), of which there are more than 250 species, and the prettily named pink petticoats (*Polypompholyx*), of which there are only two species, both in Australia. Prey are sucked into these traps through a door levered open by bristles.

As far as the evolution of carnivorous plants is concerned, the most primitive representatives, the sun pitchers, were first discovered in 1839 on the top of mountains in the deep south of Venezuela — 'an almost unclimbable range that became the model for Conan Doyle's *Lost World*.' These fleshy green plants were little more than rolled leaves that secreted nectar and collected rainwater in which insects searching for the nectar conveniently drowned. From the rolled leaf, the pitcher plants went on to develop better nectar glands, tiny vegetable umbrellas to protect the nectar from rain, and even drainage systems to prevent the pitcher filling with water and becoming top heavy.

Over the millions of years of their evolution, the pitchers became experts in the business of bribery. Nectar was carefully spread down the plant along nectar trails, the supply increasing as the insect reached the pitcher opening. Some pitchers evolved and mixed a soporific drug with their nectar. 'They get positively tight.' Slack relates, 'the insects become very unsure on their feet and zoom down the pitcher where it gets very slippery and they can't get out. But I'm convinced they die in a very happy state!' Yet another pitcher deliberately collected rainwater in which to drown insect prey. But as a great number of insects can escape an accidental ducking, this particular pitcher (*Sarracenia purpurea*) has evolved a wetting agent which it secretes into the water making it impossible for insects to lift off.

Combining all three devious devices are pitchers which collect lethal water, make drugs, and have evolved the equivalent of a maze to trap prey: semi-transparent 'windows' in the plant wall act as false exits to lure the wandering insect ever deeper to its doom.

Among the most deceptive, and attractive, is the great cobra lily (*Darlingtonia californica*). This pitcher's most singular feature is a fishtail-shaped 'tongue' that is covered with nectar and is very attractive to insects. 'They lick their way on towards the richer supplies of nectar until they reach a little mouthpiece. Above this, inside in a kind of a dome, there are the false windows. Insects, after partaking of all they require, will head for those windows, thinking they are exits; they go back and forwards trying to find their way out until eventually they reach the slippery bit at the bottom — and plummet down.'

But the most sophisticated and complex of
The most predatory looking pitcher, the cobra lily. Nectar trails and false windows in the stem of the plant lure insects to a slippery place from which they plummet to their doom.

All pitcher traps must surely be the parrot pitcher (*Sarracenia psittacina*), so called for its distinctive parrot-like ‘bill’. There is only one small entrance (it is impossible not to think of it as a mouth) into a parrot pitcher, and, as with others of the family, they lure their prey into the mouth using a trail of nectar bribes. The parrot pitcher has also evolved two convenient grooves in the direction of its mouth which some insects may follow out of convenience (although nectar is the main lure). Once inside a parrot pitcher
the insect is in real trouble. 'There is then a little tube which goes right into the inside. They go down that tube, again towards windows. They try all these little windows all the way down the pitcher to no avail, and without realizing it they pass through long thin hairs, criss-crossed.

'The hairs can be easily pushed apart going down but because of the way they are crossed there is absolutely no way back for the insect. They are caught in just the same way as a lobster is caught in a lobster pot. It is quite astounding!'

Although the complex mechanism involved is indeed remarkable, Slack is well aware that the pitchers are among the most simple of the carnivorous plants: no matter how ingenious their traps, they are still passive. However, several varieties of carnivorous plants take a much more active part in capturing their prey. Among these are a group of almost ethereal beauty if they are studied under sufficient magnification - the sundews.

Sundews are like Christmas-tree decorations in miniature. In place of leaves, their hair-like branches carry microscopic droplets of sappy ‘dew’, tiny jewels of liquid that attract and refract the light. They are lethal traps. The simple ones act like flypapers. ‘The fly lands and is immediately covered with dew. It struggles and will fall, accumulating more and more of this sticky material until all its breathing tubes are completely clogged and it expires. Tiny glands that are so small you can only see them under a microscope then come into play and start secreting the digestive fluid round the fly.’ More advanced sundews have made a great leap from the flypaper stage, evolving tentacles to hold the struggling insect in the dew trap. Cape sundews from South Africa and
forkleafed sundews from Australia are examples of these; they also fold their leaves over the trapped prey to increase the speed of digestion. Slack acknowledges that were the sundews any bigger they might well be a little frightening – 'like those awful things one reads about in American comics'.

The plants that share the ‘active flypaper’ system with the sundews – the butterworts – would never frighten anyone. In fact of all the carnivorous plants they are the most innocent in appearance, with bright-coloured flowers, and ‘leaf-shaped’ leaves. But as the great Charles Darwin demonstrated, the pretty butterworts are also sophisticated insect killers. Insects are caught in a sticky liquid secreted from the leaf-surface, and as the insect struggles, glands pump out more mucilage which eventually suffocates the prey. A second set of glands then comes into play, secreting a liquid which slowly digests the prey and absorbs the resulting nutrient fluid. To assist with digestion, by bringing a greater number of these glands to bear, the butterwort’s leaves curl inwards to cover the dying insect completely.

And, finally, to the bladderworts, which set traps that Adrian Slack extols as: ‘by far the most ingenious of all’. Bladderworts, by any definition, are very odd plants. They have no roots and it is often impossible to tell the difference between stems and leaves. They can have flowers so plain as to be inconspicuous, others so beautiful as to be called ‘fairy aprons’. One thing they all have in common are their ingenious bladder traps; tiny, no bigger than a pin head, but masterpieces of natural mechanics, and lethal.

Seemingly as innocent and beautiful as a Christmas decoration, sundews are lethal flypapers.
Sophisticated simplicity: bladderworts trap minute insects in tiny underwater bladders.

The bladders are attached to the plant at one end by a narrow stalk, while the other end is taken up with a very special door, complete with a 'lock and key' mechanism, plus machinery for impelling an insect into the trap! All the bladder traps operate in water. In the Okeefenoke swamp, bladderworts float around on little rafts, fishing with their bladders. Terrestrial species use their bladders in the wet subsoil.

Prey are urged towards the trap door by antennae that form a kind of tunnel. The trap door is, in fact, a valve, the top part fixed like a hinge, the lower hanging free. The whole structure is kept watertight by glands which secrete a mucilaginous sealant, and a membrane which locks the seal shut. Four bristle levers point in the direction of the approaching prey.

The concave sides of the bladder maintain a slight vacuum inside the trap and when an insect hits one of the bristle levers the whole mechanism is so finely integrated that the faintest push (the smallest utricularia can catch single-celled protozoans) opens the door, resulting in prey and water being flushed into the bladder. The easing of the vacuum causes the door to flip back into place. The water is then sucked out of the bladder, restoring the vacuum and within half an hour to two hours the trap is ready to work again. Once the food is inside the bladder, internal glands secrete digestive enzymes and acids.

In the process of assembling the material for this book we have come across a great many things in support of the homily 'isn't nature wonderful!' but none to really compete with the extraordinary traps of the innocuous-looking bladderworts.

Small wonder that Adrian Slack has been hypnotized by these carnivorous plants and their brothers and sisters, since first he saw their mechanisms under a microscope.

Nowadays, he spends most of his time 'playing God' in his greenhouses by creating hybrids to enhance the appearance and reputation of carnivorous plants. He takes every opportunity he can get to talk about them with evangelical intensity. 'One cannot perhaps improve upon nature but you can get a plant which grows better in cultivation, is easier for the amateur to grow, is more colourful and has a finer form. I've been doing this for over 20
Playing God in his greenhouses, Slack is able to breed and hybridize many carnivorous plants.

years now, and I’m getting some rather good plants. It’s a fascinating thing which I cannot, I shall never, tire of.

It also has a somewhat more serious purpose. Adrian Slack, who has lived in the English countryside all his life, is well aware that plants are less well protected than animals. ‘Apparently no day goes by without some plant becoming extinct somewhere in the world. A lot of these carnivorous plants are threatened.

‘But I do believe some sense will prevail in the end and in the meantime species are being kept alive “in captivity”. Some of the American pitchers are practically extinct in nature, but fortunately some of my friends have kept them going and now are replanting them back into the Appalachian mountains.’

Adrian Slack, fortunately, is a comparatively young man and is hardly likely to be tempted away from his almost idyllic existence in Somerset. It may seem bizarre that flesh-eating plants of the tropics have found a haven, with a vegetarian, in a greenhouse in south-west England, but it hardly matters if the existence of the species is at stake.

They could not be in better hands.

Reference
