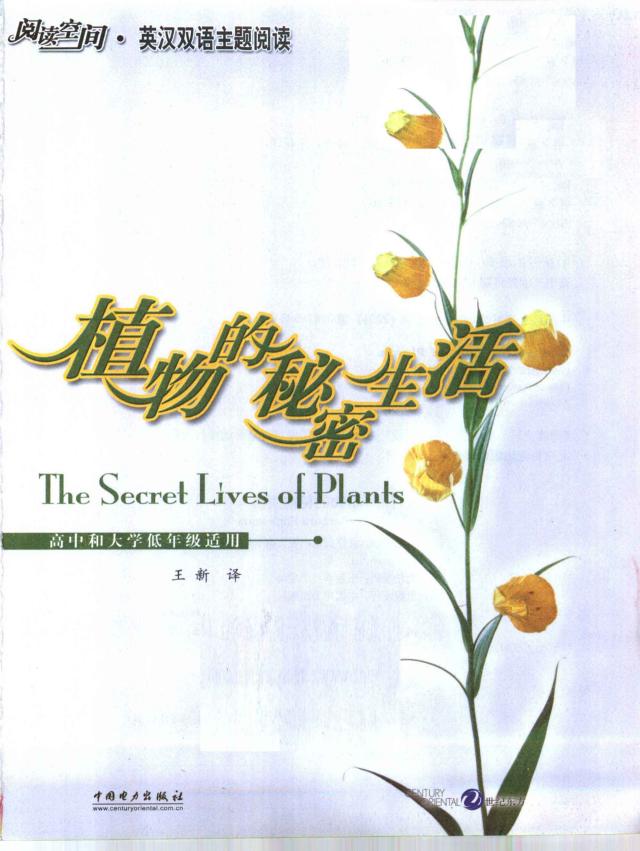
阅读空间 • 英汉双语主题阅读



The Secret Lives of Plants





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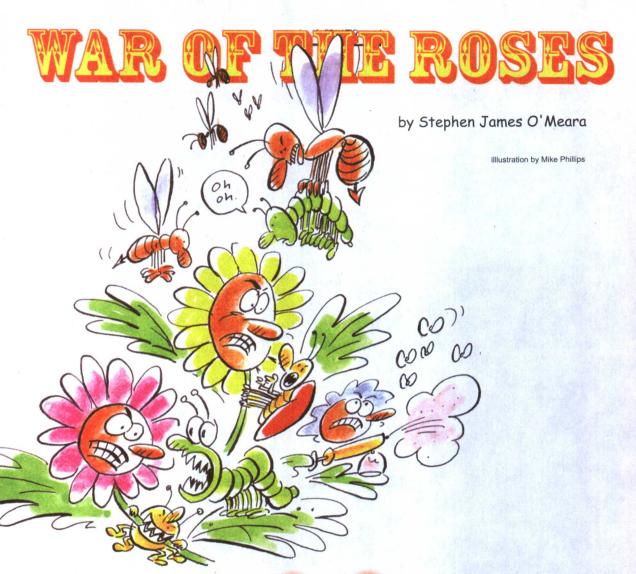
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Editor's Message 编辑手记

计法 军再完敕DDF违法的





e've all smelled it — that fresh aroma of raw earth rising up from a garden after a summer rain. But as pleasing as that smell is to us, it's the smell of war...to a microbe!

That's right. The smell we love to sniff after a summer shower is really an invisible cloud of some pretty "poisonous" chemicals released by soil-dwelling bacteria fighting for territory. The microbes use the gas as a biological weapon, to keep competitors away. David Bodanis, author of *The Secret Family* (Simon & Schuster, 1997), says that the smell is always there, but it simply becomes more noticeable to humans in the increased humidity after a rain.

And there's more to that sweet smell of a humid summer day. Shrubs, Bodanis says, "send an odorif-erous alcohol upward to spotlight the point where they're being attacked by caterpillars or other gnawing insects." The odor, however, is not intended to gas out the leaf munchers. No, it's a chemical message aimed at wasps, to attract them to the caterpillars, the wasp's prey.

More of the aroma of summer comes from flowers planted too closely together, Bodanis says. Plants do not take such crowding lightly. To battle their neighbors, plants send hydrogen cyanide from their roots into the soil to annihilate encroachers. Rosebushes, too, are not averse to killing. They send out gases that try to counterattack fungi.

Yes, Bodanis warns us, it's a jungle out there, and we're blind to it. But we can sniff out the danger.

我们都闻到了:夏日一场大雨过后, 花园中那散发着新土的清香。虽然 这气息令人们愉悦,但对微生物而言,它 却是一种战争的气息!

的确如此。雨后我们喜欢闻的味道,确实是一些"有毒"化学物质形成的一种看不见的云,是由泥土里的细菌在争夺地盘时散发出来的。微生物用气体作为生物武器,以排斥竞争对手。大卫·波德尼斯是《神秘家庭》一书的作者,他说,这种气味一直都有,只不过是在雨后湿度增加时人们更加容易感觉到。

夏日湿润天气里这种甜味带来的还不 止这些。波德尼斯说,灌木丛"向上散发 一种酒精的臭气,聚集在它们被毛毛虫或 者其他嘶咬昆虫攻击的地方。"但是,释放 这种气味的目的并不是要赶走那些咀嚼叶 子的昆虫。不是的,这是发给黄蜂的一种 化学信号,把毛毛虫的天敌黄蜂吸引到这 里来。

波德尼斯说,由于很多花卉间的距离 过近,它们也会散发出这种夏天的香气。 植物并不喜欢这么近的距离,为了战胜邻居,它们会从根部释放出氰化物,渗入土 壤,从而摧毁入侵者。同样,玫瑰们也是 毫不犹豫的杀手,它们会释放出气体反攻 真菌。

波德尼斯警告我们,是的,外面是一 片你死我活的丛林,我们却视而不见。但 是,我们可以闻到"战争的硝烟"。

by Barbara Eaglesham 6



ho doesn't love flowers? We enjoy their bright colors, unique shapes, and sweet aromas. But have you ever stopped to think, What would life be like without them? No more cotton T-shirts and jeans, and no more cereal, orange juice, and coffee — because these all come from flowering plants. Come to think of it, no more bacon, either. (After all, what do pigs eat?) No more grass to walk on, no more trees to lie under, and much less oxygen to breathe. You guessed it. If it weren't for flowering plants, you wouldn't be here reading this page right now, either!

So, what exactly are flowers, anyway? Where did they come from, and what makes them so special?

1年不爱花?我们享受着它们亮丽的颜色,独特的造型,芬芳的气味。但是你有没有停下来想过,如果没有花这个世界会变成什么样子?不再会有纯棉的 T 恤衫和牛仔裤,没有了谷物、橙汁、咖啡,因为这些都来源于开花植物。仔细想一想,也不再会有腌肉。(说到底,猪吃什么呀?)人也不可能在草地上行走,在树下躺卧,也没有这么多的氧气供人呼吸。你猜对了。如果没有开花植物,你也不会在这里看这本书了!

那么,什么是花?它们从哪里来, 什么使得它们如此特别?

A ROSE BY ANY OTHER NAME

If you could watch an hour-long movie of the history of the Earth, flowering plants would show up just before the credits. Somehow, though they made their appearance as recently (geologically speaking) as 130 million years ago, they literally have taken over the Earth. They invade and adapt even to extreme environments such as deserts, rocky mountaintops, and wetlands. They now number about 350,000 species. That's 20 times that of nonflowering seed plants, which have existed nearly three times as long.

A flower is more than just a pretty face. It contains ovules - the female parts of the plant that are fertilized by pollen, the equivalent of sperm in mammals, to become the seeds - enclosed within a structure called a carpel. (When you eat an apple, the carpels are the annoying hard bits in the middle that hold the seeds.) Both the ovule and the pollen -afine, powderlike material produced by the flower's anthers - contain genetic information that, when combined, will deter-

mine what the plant will be like, or its "phenotype." In nonflowering seed plants, ovules - and thus the seeds are not encased.

This seed characteristic determines how the two types of plants were named.

Anther

Pollen-bearing part of the stamen, the pollen-producing reproductive organ of a flower usually consisting of a filament and an anther



如果你观看一部长达一小时的关于地球历史 的影片, 开花植物应该出现在摄制人员名单的前 面。尽管这些植物中最晚的(从地质学上看)在1.3 亿年前才出现,但它们实际上已经占领了地球。它 们入侵并扩张到一些极度恶劣的环境中, 如炎热 沙漠、山岩之顶或沼泽地带。开花植物大约有35 万种,是无花种子植物的20倍,而后者在地球上 存在的历史是开花植物的三倍之久。

一朵花并不仅仅是一张漂亮的脸。花还包括 胚珠——这是植物中的雌性部分,由花粉受精而 成为种子,花粉相当于哺乳动物中的精子,胚珠被 包在一个称为心皮的结构中。(当你吃苹果的时 候, 心皮就是中间包含种子的那个

让人讨厌的坚硬部分)。花粉是花 粉囊产生的粉状物质,它和胚珠 都包含基因信息, 二者结合时, 就会决定一株植物会长成什么 样子,或者说决定它的"显性"。 在无花的种子植物中, 胚珠, 也就是种子,是赤裸的。

种子的这一特性决定了两种

Angiosperm comes from the Greek words angeion, meaning "vessel", and sperma, meaning "seed". Gymnosperm contains the Greek word gymnos, which means "naked". Flowering plants, or angiosperms, have "seed vessels," or carpels, and gymnosperms, or nonflowering seed plants (think cone-bearing, and palm-like trees, and ginkgos) have "naked seed." Just as mammals evolved from egg-laying creatures to those who carry their young inside them, so too have flowering plants.

The ovules in a gymnosperm are only partly enclosed, such as in a pine cone. In pines, when a pollen grain is blown by the wind onto a *micropyle*, the opening at the top of an ovule, it sticks if the micropyle is moist. With evaporation, the pollen grain is drawn into the ovule, where fertilization, and then seed production, occur.

SOWING THE SEEDS OF SUCCESS

Angiosperms do not have to rely solely on wind for the transfer of pollen. They are fortunate in having many pollination partners. *Pollination* in flowering plants is the movement of pollen within a flower, between flowers on the same plant, or between the flowers of distant unrelated plants, to produce fruits and seeds. (Botanically, most flowers are

hermaphrodites, which means that they have both male and female parts.)

An insect can feed on pollen or nectar (an energy-rich liquid produced by a plant), or both. As an insect feeds, its hairs brush against the pollen-laden anthers of the stamen, the male part of the plant, and become dusted with it. As the insect makes its rounds, it brushes against the stigmas of subsequent flowers, thus giving a

植物的名称。被子植物来自于希腊词 angeion (意思是 "容器") 和 sperma (意思是 "种子")。裸子植物包含希腊词gymnos, 意思是 "裸露着的"。开花植物或被子植物, 具有 "种子容器"或心皮, 裸子植物或无花植物 (想一下有带球果和棕榈类的树木以及银杏) 有着裸露的种子。就像哺乳动物从卵生进化到胎生一样, 开花植物也是如此。

被子植物中的胚珠仅是部分被包裹, 例如松球。在松树上,当一粒花粉被风吹 落在株孔上的时候,也就是胚珠的顶上开口端,如果株孔湿润,花粉就会被粘住。在 蒸发的作用下,花粉就会被吸入胚株,并 在此受精结种。

播下成功的种子

被子植物并不仅仅依靠风传播花粉, 它们很幸运,有多种授粉伙伴。开花植物 的授粉,就是花粉在同一朵花、同株植物 的不同朵花之间或者在跟距离很远没有关 联的植物的花朵之间的传播,授粉的目的 是育种结果。(从植物角度讲,大多数花都 是雌雄同体的,意思是既有雌性部分,也 有雄性部分)。

昆虫可以以花粉或花蜜(植物产生的



helping hand to the flowers by pollinating them. A *stigma* is the tip of the tube, called a *style*, that leads down into the ovary, the female part of the plant. A chemical reaction determines whether the pollen will produce a pollen tube to reach the ovule for fertilization. If the pollen grain is from a different species, the pollen tube won't develop.

Less frequently, mammals also transfer pollen in this way, dusting as they go. Bats and birds do the same, and humans have gone a step further by learning to cultivate plants, sometimes pollinating precious species by hand to breed new phenotypes. Dinosaurs also helped the spread of flowering plants, but in a different way. Some of the shorter, plant-eating members, like duck-billed dinosaurs, may have behaved like tractors, munching areas clear of vegetation and sowing seeds from their feces.

FROM WALLFLOWER TO BEAUTY IN THE BLINK OF AN EYE

The flowers of the very earliest angiosperms were, well, probably not very attractive. Most looked nothing like what we think of as a flower today. Early on, they lacked petals and were probably not very colorful — and some were as small as the head of a pin. You probably wouldn't choose broccoli florets as a centerpiece. So too the very early species wouldn't have been especially alluring to insects, though they were probably unintentionally pollinated by them. Gradually, through a series of genetic mutations in both flowers and insects, structures began to evolve that caused flowers to be noticed, and therefore visited more frequently by insects. In

一种高能量液体)为食,有的二者都吃。昆虫吃食的时候,触须接触了雄蕊上充满花粉的花粉囊,便粘上了花粉。雄蕊是植物中的雄性部分。随着昆虫往来飞行,它会碰到下一朵花的柱头,这样就帮助了花朵受精。柱头是管状花柱的顶部,花柱通往花的雌性部分,也就是子房。一种化学反应会决定花粉是否会产生花粉管并伸向子房进行受精。花粉如果来自一株不同种类的作物,就不会产生花柱。

有时,哺乳动物也会粘上花粉,并一路帮助传播,但没有昆虫授粉的情况频繁。蝙蝠和鸟类也会有这样的行为,人类更向前迈了一步,学会了培育植物,有时为了培育新的基因型而对珍稀品种进行人工授精。恐龙也帮助传播开花植物,但是以不同的方式。一些体形矮小、食草的恐龙,诸如鸭嘴兽恐龙,其行为就像拖拉机一样,把一个地区的植物全部食光,然后通过粪便重新播种。

瞬间, 从桂竹香到美丽花朵

最早的被子植物的花朵可能不是很有吸引力,大部分不像现在人们认为的花。早期,花朵没有花瓣,可能也不是五颜六色的,有一些小的只有针头一般大。你也许不会选择椰菜花(即西兰花)作为餐桌中间的摆饰。最早的开花植物很可能也不特别吸引昆虫,尽管它们在不经意地帮助植物授粉。渐渐地,花以及昆虫经过一系列的基因突变,结构开始进化,花变得更为注目,因此也就招引了更多的昆虫。另一方面,昆虫身体构造的进化也使它们能够更好地利用植物提供的甜美花蜜和花粉。当两组生物一同进化,形成这样一个相互依靠的关系时,就成了我们所说的共同进化。

一旦花朵有了花瓣,就发生了富有戏剧性的变化。在进化进程中的一瞬间,被子植物的种类和品种急剧增加,这一过程称为"大辐射",发生于约九千万年到一亿年前。花变得更招眼,

turn, insects evolved structures that allowed them to take better advantage of what plants had to offer, tasty nectar and pollen. When two groups of organisms evolve together into a codependence such as this, it is known as *co-evolution*.

Once flowers developed petals, something dramatic happened. In what seems like the blink of an eye in evolutionary time, there was an explosion in the number of species and diversity of angiosperms. Known as the "great radiation," this increase occurred approximately 90 to 100 million years ago. Flowers became showier, developing different shapes and color patterns that attracted insects. The large, tongue-like petals of orchids, for instance, seem tailor-made landing platforms for pollinators. Insect pollination, the short life cycle of most flowering plants, and some lucky mutations combined to create a period of rapid evolution that astounded even Charles Darwin, who described this period as an "abominable mystery."

CLIMBING THE FAMILY TREE

How do we know all this? Scientists have a box of tools at their disposal that traditionally included just fossils and microscopes. Today, scanning electron microscopes, which magnify thousands of times, are used routinely to study tiny fossil flowers. Biochemists have found a chemical specific to flowering plants in fossil rock as old as 250 million years, a kind of "molecular fossil," which may mean that they have found the earliest evidence of flowering plants.

Just as angiosperms went through a period of rapid evolution, the 并出现了更吸引昆虫的不同形状和奇异的颜色。例如,兰花舌头状的花瓣似乎是专门为授粉的昆虫提供的平台。昆虫授粉、多数开花植物的短暂生命期,以及一些幸运的突变,这一切共同创造了一个快速的进化期,就连达尔文也惊奇地称之为一种"令人恶心的神话"。

查阅家谱

人们是如何了解这一切的? 科学家有一个可以随时使用的工具箱,传统上只包括化石和显微镜。现在能够放大上万倍的电子扫描显微镜经常被用于研究微小的花的化石。在具有2.5亿年历史的化石中,生物化学家发现了一种开花植物特有的化学物质,这是一种"分子化石",这可能意味着他们找到了最早的开花植物的证据。

正如被子植物经历过一段快速进化期一



field of plant molecular genetics is experiencing dramatic leaps as technology advances, more and more data are gathered, and computer programs are designed to handle it. Coordinated efforts are being made to explain entire genetic codes of organisms such as Arabidopsis thaliana, a small-flowering member of the mustard family, whose code is now complete. Comparison of specific genetic sequences tells scientists which plants are closely related and allows placement of them into groups called clades. This is different from the method developed 250 years ago by Carl Linnaeus and still used today. The Linnaeus method groups plants together according to similarities in the number of flower parts. Genetic analysis has shown that some plants originally thought to be related, like the water lily and the lotus, belong to different branches of the phylogenetic tree, the genetic family tree of plants.

As fossils are unearthed, they are positioned on the tree according to similarities they bear to present-day plants. Genetic analysis isn't possible on fossil material. Early in 2002, a dramatic discovery was made in China by a research team. Scientists from China, the University of Florida, and Cornell University discovered beautifully preserved plant fossils from at least 124.6 million years ago. After careful study, the fossils were found to represent two different — but related — species that are not closely related to any other known plants. In fact, they were given a new family name, *Archaefructus senensis*, which means "oldest fruit from China". They alone represent the very first, and oldest, branch of angiosperms, now extinct.

样,植物分子基因学也随着技术讲步而 取得了高速飞跃, 研究人员收集到越来 越多的信息,也设计了计算机程序来处 理这些信息。科学家合作揭示诸如拟南 芥菜之类的生物体的基因密码, 这是 芥菜家族一种开小花的成员, 目前解 码工作已经完成。对具体基因序列的 比较告诉科学家哪些植物是有亲缘关 系的,并可以把它们归入称为进化枝 的小组。这与250年前卡尔·林奈发明 的方法截然不同,他的方法现在依然 在使用。 林奈的方法是根据开花部分 的数量划分植物。基因分析法表明,有 一些原本以为是近亲的植物, 例如荷 花和莲花,实际上在物种种类史家谱 中属于不同的分支,这类物种发展系 谱就是植物的族谱。

化石出土后,按照与现代植物的相似性在族谱中被定位。对这些化石进行基因分析是不可能的。2002 年初,中国的一个研究小组有了惊人的发现。来自中国、佛罗里达大学、康奈尔大学的科学家发现了保存完好的植物化石,至少也有1.246亿年。经仔细研究后,科学家发现这些化石代表两种截然不同但有关联的物种,这些物种与目前任何已知的其他物种都没有近亲关系。事实上,它们被起了一个新的属名,叫"中华古果",意思是"中国最古老的水果"。这种植物代表了现已灭绝的第一个也是最古老的被子植物的分支。

COLLECTING THE FRUITS

Is this information important? Yes, for many reasons. The more information we have about where plants belong on the phylogenetic tree, the more we can make predictions about their characteristics. This information could help us design better plants through biotechnology and plant breeding. Most new drugs are derived from plants, and being able to identify close relatives might aid in the discovery of similar drugs, or more abundant sources .

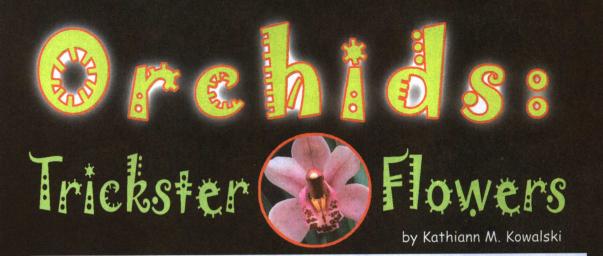
Plants serve us in ways of which many of us are unaware. For example, according to Rui Hai Liu, a physician and toxicologist with the Department of Food Science at Cornell University, "there are more than 8,000 plant chemicals in unique combinations in different plants." These function in different ways, some fighting against carcinogens, others against inflammation, and still others against the oxidation of cells. He claims that taking vitamins will never yield the same health benefits as eating a wide range of fruits and vegetables. So, the next time you find yourself turning up your nose at broccoli. . . think again, and have a little respect for that not-so-lowly flower.

收获果实

这个信息重要吗?是的,理由很多。我们对于植物在物种种类史家谱中的位置了解的信息越多,我们越可以准确地预测其特性,这可以帮助我们利用生物技术和植物育种,培育出更好的品种。大部分新药来自植物,能够辨别近亲关系有助于发明类似药物,或者发现更丰富的药物资源。

植物以很多方式为我们服务,我们很多人对此却没有认识。例如,按照康奈尔大学食品科学系毒物学者刘瑞海医生的说法:"有8000多种植物化学物质,在不同的植物中以独特的方式结合。"这些化学物质的功能各不相同,有些抑制致癌物质,有些抗炎症,还有一些防止细胞氧化。他宣称:用维生素为健康带来的作用永远比不上吃各类蔬菜水果的好处。所以,下一次如果发现自己对西兰花嗤之以鼻的时候,仔细考虑一下,尊重一下这种不是那么低级的花。





f you thought orchids were just pretty flowers, think again. With about 35,000 wild species, orchids may be Earth's biggest family of green plants. Most species live in tropical rain forests, but orchids thrive on every continent except Antarctica. And orchids have evolved some amazing survival tricks.

POLLINATION PLOYS

Orchids produce flowers for one purpose: to reproduce. Most species must combine DNA (the genetic blueprint) from two parent plants. But, like most plants, orchids are rooted in one place. Plus, there often isn't another orchid close by for *cross-pollination*. To spread their pollen, many orchids rely on *specific* pollinator insects. Often, that's more efficient than attracting insects that visit many kinds of flowers.

"It would be like having your own private mail courier service rather than relying on an inefficient post office that might lose your mail, your gametes," explains Mark Gametes

Cross-pollination
The transfer of pollen from the anther of the flower of one plant to the stigma of the flower of another plant so that it can fertilize egg cells and form seeds

Gametes

Male or female sex cells

果你认为兰花仅仅是美丽而已,最好再仔细想一想。野生兰花约有35000种,可能是地球上最大的绿色植物家族。大部分兰花生活在热带雨林中,但是除了南极洲,它们在地球上的每一个大洲都扎下了根。而且,兰花在进化中形成了一些十分有趣的生存技巧。

授粉策略

兰花开花只有一个目的:繁衍后代。 大部分种类的兰花需要把来自双亲的 DNA(基因蓝图)结合,但是,像大多数 植物一样,兰花一般植根于一个地方,而 且一般没有另外一株兰花长在附近以供交 叉授粉。为了传播花粉,很多兰花依靠特 定种类的授粉昆虫,而且这比吸引拜访很