

Glimpses of Nature.

V.—MARRIAGE AMONG THE CLOVERS.

BY GRANT ALLEN.



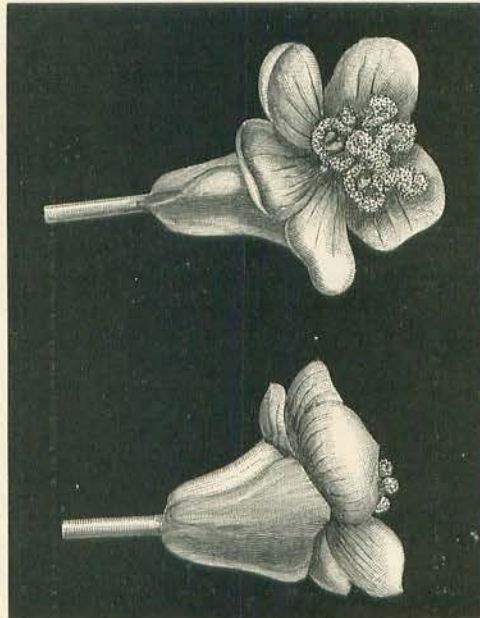
PLANTS marry and give in marriage just as truly as animals. They have their loves and their hatreds, their friendships and their enmities. The marriage customs of many among them are vastly interesting; and yet, in spite of all the attention that has been given to the subject of recent years, comparatively few people are even now aware how quaintly they pair, how varied and curious are their matrimonial arrangements. Most of us, it is true, have heard by this time the bare facts of the case—that flowers are mainly fertilized by the visits of insects: many of us even know that in the majority of instances the little golden dust which we call pollen must be transferred from the hanging bags on one blossom to the sensitive surface of another, or else seed will never be set: but not all of us are aware how intricate and how numerous are the minor devices by which each kind of plant effects this important object in its own fashion. I am going, therefore, in the present paper to describe briefly the marriage customs of two alone among our commonest English clovers, which I shall adduce as specimens of the strange variety to be found within the limits of a single type.

To begin with, however, I propose to examine, as a mere introduction, a couple of flowers of a well-known and dainty hot-house begonia, which may help us to the comprehension of the more plebeian clover-heads. Proverbial philosophy has long since taught us that "the longest way round is the shortest way home"; and when I drag in the begonia, which has apparently so little connection with clover, and which is really about as unrelated to it by

descent as two flowering plants can well be to one another, you may suspect that I do so for some sufficient reason. The fact is, begonias happen to be plants in which the differences of the sexes are exceptionally well marked, so that they may be apprehended with ease by the naked eye and by every observer, even the most casual. I advise those who have conservatories of their own to verify my statements in this matter on the specimens in their possession; for those who have not, Mr. Enock's excellent illustrations, which accompany this paper, will serve almost as well as the original objects.

Most cultivated begonias have the flowers on their branches arranged in groups or clusters of three, the central one of which is often a female, while the two outer blossoms are usually males. This is the ordinary plan, but it does not hold good of all the species, some of which on the contrary have only one male to each pair of females. Now, these male and female flowers are so very unlike in form and structure, when you come to look into them, that you would hardly believe they belonged to the same plant, if you did not find them growing on one branch together. They differ quite as markedly as the peacock differs from the pea-hen, much more markedly than man differs from woman. A glance at No. 1, and then at No. 4, will make this point obvious. You would say, if shown them separately, that these two blossoms must surely be flowers of quite distinct species; yet they hang side by side on one and the same plant like brothers and sisters.

The first point of difference which you will note in the two is that the female begonia, as seen in No. 1, has five petals, while the male, in Nos. 4 and 5, has four only. (I call them petals both for



1.—FEMALE BEGONIA FLOWERS, FRONT AND BACK VIEW, SHOWING THE SEED-BAG.

brevity's sake and because I believe them to be so in reality, though fear of that terrible critic, Dr. Smelfungus, who goes about like a roaring lion seeking whom he may devour, compels me to add that in the learned Doctor's opinion they are parts of the calyx—a petty distinction with which but for him I would not have troubled you.) But what is far more important than the number of the petals is the fact that the female flower has wedged at its back a large triangular winged ovary, or seed-capsule. It is the possession of this ovary, indeed, that marks it out at once as a female: for by a female plant or animal we mean, of course, the one which lays the eggs, produces the seeds, or becomes the mother of the young individuals. If you compare the back of the female flower in the lower portion of No. 1 with the back of the male flower in No. 5, you will recognise at once the importance of this distinction. The female blossom has a seed-bag, while the male is barren. In No. 2 we have represented one such seed-bag cut open cross-wise, so as to show both the projecting wings and the numerous little seeds in the three cells within. When once one has examined a begonia plant from this point of view, one can never again doubt the reality of sex in plants, and its exact analogy to the same distinction as it exists among animals.

But this is not all: the other parts of the two flowers differ almost equally. The centre of the female blossom is occupied, you will observe, by several twisted and wriggling arms, the upper surface of which is more or less sticky. This surface forms the receptive portion, or mouth, of the flower, on which grains of pollen must be duly deposited before the embryo seeds in the capsule below can begin to swell and develop. On the other hand, the centre of the male flower, as seen in No. 4, is occupied by a set of very different organs, the stamens

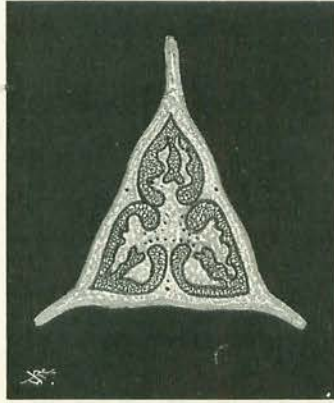
or pollen-bags, whose business it is to produce and shed the fertilizing powder. Without pollen to start them, the seeds are useless. In the wild state, any winged insect which visits the plant

is likely to alight first on the lip or platform of one or other of the outer male flowers. In his search for honey, which is secreted by the plant at the base of the petals on purpose to allure him, the flying visitor dusts himself over abundantly, though unconsciously, with grains of pollen from the very numerous little sacs which are placed there in a convenient situation with that precise object. He then flies away to the female flower, in which he alights, as a rule, on the central sticky portion (called by

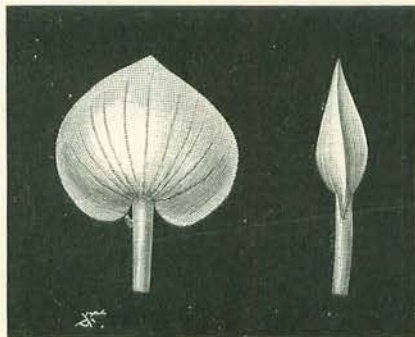
botanists the stigma): and as he walks over it in search of the honey at the base of each petal, he turns himself round and round in five directions, and thus unwittingly rubs off the pollen which clings to his legs and hairs, transferring it to the sticky and receptive surface. After visiting and fertilizing the female flower in the centre in this manner, he then usually proceeds to visit the second brother beside it, from which he carries away pollen in turn to the next plant he visits. The object of this curious arrangement is that each flower may be fertilized by pollen from another blossom, and, as far as possible, in many instances at least,

by pollen from a distinct neighbouring plant. But you will gather at once from what I have said already that each plant must be regarded in strictness not as an individual, but rather as a community or commonwealth, of which the leaves and flowers are the separate members told off to perform different duties. You may compare it, indeed, to a hive of bees, the leaves

representing the workers, while the five-petalled flowers are analogous to the queen-bees, and the four-petalled blossoms to the husbands or drones. Nay, more: those of my readers who have begonia



2.—THE SEED-BAG, CUT ACROSS.

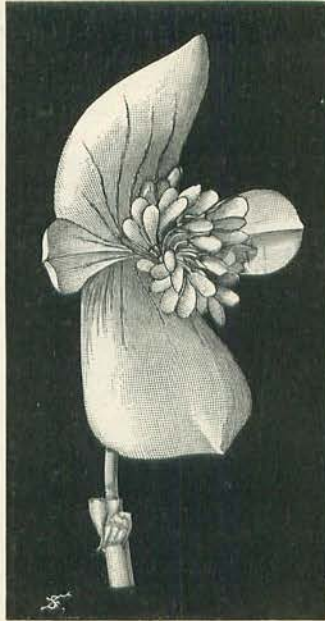


3.—MALE BEGONIA FLOWERS IN THE BUD, WITH NO SEED-BAG.

plants of their own may observe for themselves another singular resemblance to the habits and manners of honey-bees. For after the drones have done their work in life by fertilizing the queen-bee, the prudent workers sting them to death, as being useless mouths, of no further benefit to the community; but the queen-bee necessarily survives to become the mother of young swarms, or future generations. If *she* were killed, it would be all up with the community. Just so with the begonias; as soon as the male flowers have performed their whole duty in life, by producing and disseminating the grains of pollen which the insects carry away and smear upon the sister blossoms, they break off at the joint shown in the illustrations, and fall to the ground; the plant refuses to feed them any longer, because it has now no use for them: but the fertilized female flowers remain fixed on their stems to produce the seeds, from which will spring in time the future generations.

What, however, do I mean by fertilization?

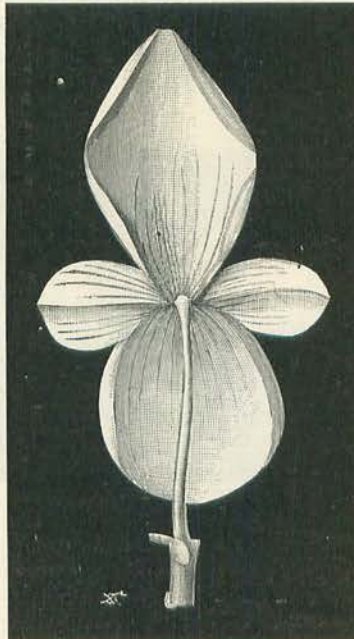
Well, each pollen-grain, when closely examined under a microscope, looks like a tiny egg, with a very thin shell and very sticky, active contents. As soon as the pollen-grains are rubbed all over the curly branches in the centre of the female flower, they empty their contents down long tubes, which reach at last to the seeds; and under this vivifying influence, the seeds begin to swell and become capable of producing young plants. The pollen, in short, has quickening power. It is for the sake of this final result alone that the flowers exist: they are provided with bright-coloured petals as advertisements to let the insects know where honey may be expected; they



4.—MALE BEGONIA FLOWER, FRONT VIEW.

large petals, afterwards used as platforms for the insect to alight upon, inclose the smaller pair of interior ones, as well as the bunch of yellow stamens. But as these stamens are full of nutriment, and therefore liable to be prematurely attacked by useless gnawing insects, the petal above them is thickened in

this part, and in one of the species most cultivated in our green-houses, but not figured here, is provided with little protective hairs, which baffle and keep at bay all hungry aggressors. I may add that the projecting wings on the seed-vessel, well seen in No. 1, and also in the section in No. 2, serve a somewhat similar purpose: they are intended to prevent hostile insects from laying their eggs at the most vulnerable points in the capsule, where the grubs would destroy the seeds within. The thickenings above and below, also to be observed in the lower figure of No. 1, perform a like service. They are devices of the mother to protect her young. You will thus perceive that the



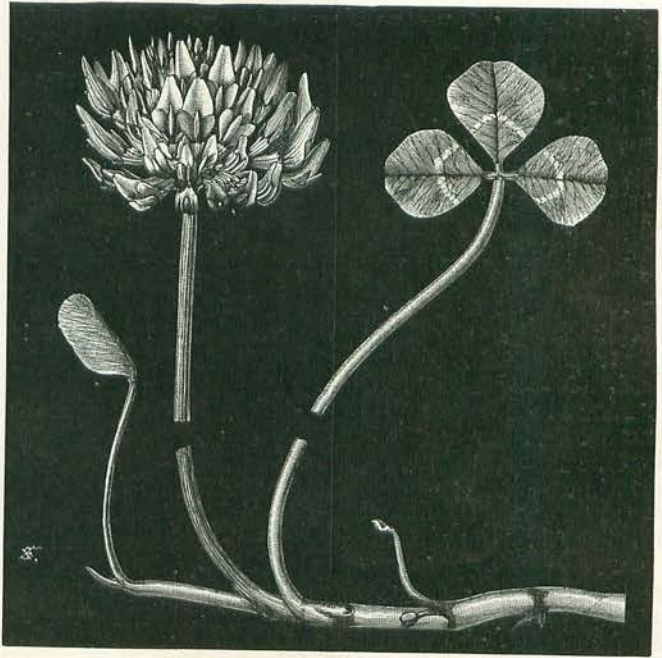
5.—MALE BEGONIA FLOWER, BACK VIEW.

begonia has its friends and its enemies in the insect world, and that while it does its best to conciliate the one, it is no less anxious to repel the other. We shall find in the sequel that precisely the same thing is true of the clovers.

To the clovers then, which are our proper subject, I will next proceed. And I began with the begonia by way of introduction, only because that afforded us a case in which the husbands and wives of the community were so distinct from one another that nobody with a pair of eyes in his head could fail to distinguish them when they were once pointed out to him. In the clovers, on the other hand, we have a much more complicated arrangement, and one much less like the ordinary cases with which we are familiar in the animal world. Here, the flowers are collected in heads or clusters, and each flower is in itself at once both male and female. This method, indeed, is common amongst plants; it occurs in by far the greater number of species: the reason why I started with the begonia is just because in that type the sexes are so well and clearly separated in distinct blossoms. In the clovers, however, of which we have about twenty species in England, each separate flower resembles a small pea-blossom in shape, having four petals, which botanists name respectively, from below upwards, the keel, the two wings, and the standard. These petals are best seen in the single up-standing flower (or "old maid") represented in No. 9. They are inclosed beneath in a small greenish calyx or cup, and they contain within them ten stamens or pollen-bags, as well as a tiny capsule like a miniature pea-pod. At the tip of this capsule is a small hook—the sensitive surface on which the pollen has to be deposited. You would say at first sight that under such circumstances, male and females being mixed up in one, cross-fertilization must be impossible—that each flower must surely be fertilized by its own pollen. But the clever clovers have invented an ingenious little device of their own for overcoming this difficulty: the pollen-bags and the sensitive

surface of the capsule do not arrive at maturity together. In this way each flower or plant gets fertilized itself at one time by pollen from another plant, and at another time dusts the bee that visits it with its own pollen, which the bee transfers in due course to the next plant it visits.*

No. 6 represents part of a plant of Dutch clover—the common white clover of our meadows and pastures. It is called Dutch, not I believe because it is particularly common in Holland more than in other European countries, but because the prudent Dutch were the first agriculturists to collect and export the seed of this particular clover separated from all other seeds of similar but less useful species. It happens to be a particularly good fodder plant, and it grew wild originally



6.—DUTCH CLOVER, BEFORE MARRIAGE.

throughout the whole of Europe and temperate Asia, from the Mediterranean to the north of Norway. But the seed has now been sown for pasture in almost every country of the civilized world, so that wherever *THE STRAND MAGAZINE* circulates, its readers can find and observe the plant for themselves, "to witness if I lie," as Macaulay's Roman poet bluntly puts it. Dutch clover is a rather smooth specimen of its type, not nearly so

* I hope technical botanists will forgive me some slight but unimportant simplifications in this not entirely accurate mode of presentation.

hairy or silky as most other clovers, for a reason which I will explain a little later on: it has prostrate stems which creep along the ground, as shown in the illustration, and root every now and again as they proceed, somewhat after the same fashion as strawberry-runners. Like all other clovers, it has trefoil leaves, each of the three leaflets in which is usually marked with a curved spot in the centre resembling a horse-shoe. But it is the flower-heads with which I am here particularly concerned. These are raised on long, erect, leafless stems, each of which bears at its summit a globular head of little white pea-flowers, often delicately tinged with pink or salmon. The flowers are thus lifted to a considerable height, because this clover grows, as a rule, among rather tall grasses, and so tries to push up its marriageable blossoms to a height where they may receive the polite attentions of passing insects. It is anxious to see its boys and girls well married.

The visitors for which Dutch clover specially lays itself out are for the most part bees. It disdains small pilferers. Each blossom has a long tube inclosing its honey, and only insects with a correspondingly long proboscis can reach its deep store of delicious nectar. It thus saves itself from being rifled uselessly by small insect riff-raff, such as flies and midges, which might visit the flower, as we botanists call it, "illegitimately"—that is to say, might rob the honey without conveying the pollen from the pollen-bags of one head to the sensitive surface or stigma of the next. The parts of the flower, in fact, are specially arranged with a definite relation to the head and the honey-sucking tube of hive bees and wild bees, which cannot visit it without dusting themselves over with pollen on one blossom which they unconsciously rub off on the receptive surface of the next. In one word, Dutch clover encourages bees for its own purposes, because they are useful to it, while it places obstacles in the way of smaller and useless insects, by burying its honey in a deep tube.

The head of Dutch clover shown in No. 6 is one which has been caught just at the very first moment of flowering. The florets or blossoms which make up the head begin opening from without and below, inward and upward. Thus in this head the outer and lower florets have opened, while the inner and upper ones are still in the bud. When a bee visits such a head of clover, he comes to it first from another head of the same kind; for bees do not usually mix their liquors; on one round of visits they confine themselves, as a rule, to a single species of flower only, and they probably store the honey of each kind in separate cells, just as we ourselves in our wine-cellar keep one bin for champagne, another for claret, and a third for Burgundy. The bee thus begins with the outer flower of the head, which he fertilizes with pollen from the last plant he visited; he then goes on to the second row, where he dusts himself over with pollen for another flower-head; and the buds in the centre he leaves severely unnoticed.

As soon as he flies away, a very curious thing begins to happen. The flowers which he has unconsciously fertilized close over their seed-vessel, and grow gradually brown or withered. At the same time, as you see in No. 7, they turn down out of the way of the bees by bending the separate little stalks on which they are raised in the head, and tucking



7.—DUTCH CLOVER, THE FERTILIZED FLOWERS TURNED DOWN, THE UNFERTILIZED COURTING THE BEES.

themselves tight against the common flower stem. This they do partly in order not to confuse and worry their allies the bees, but partly also to avoid certain other dangers to which I will recur later. Plants often try in such ways to save bees or butterflies time and trouble, because the easier they make matters for the bee or butterfly, the more likely is he to visit and fertilize them. He is a useful customer whom they desire to conciliate. If a bee on his rounds finds that any particular species of plant gives him unnecessary trouble in getting at the honey, he is apt to neglect it and pass it by, in order to devote himself to other kinds which he sees

are more business-like and obliging. The moment he comes to a head of Dutch clover, then he knows at once that he may safely ignore the dry, brown flowers tucked away against the stem, because they are already fertilized and honeyless; he therefore directs all his attention to the mature and opened flowers which are now producing honey and ready for fertilization. These form practically, as you will see, at each moment the outer row of the flower-head, and are the ones which naturally first engage his notice as he alights on the cluster.

No. 8 shows us the same head in a little later stage of advancement. Here, almost all the flowers have now been fertilized, and they are therefore turning their brown and faded florets downward against the stem. Two among them, which the bee has only just left, are caught in the very act of bending down, so as to get out of the way of any further visitor. The flowers in the centre, which are still erect, were not yet opened when the last bee paid a passing call on the community. They have unfolded their petals since, and are now standing up awaiting their turn to be visited by their winged ally, relieved of their honey, and duly fertilized. It sometimes takes four or five days for a single head to pass through all its stages.

In No. 9 we have a truly pathetic picture of a solitary old maid, perked up desolate and alone in the midst of her happier married sisters. She was an unopened bud when some passing honey-gatherer visited and set the seeds of her more fortunate relations. The flower on her left, to be sure, has only just turned; it was the



8.—DUTCH CLOVER, WITH ALMOST ALL THE FLOWERS FERTILIZED, AND TWO JUST TURNING DOWN.



9.—DUTCH CLOVER, A SOLITARY OLD MAID.

last to receive attention from its winged allies. If you search a field of Dutch clover, you will find every here and there such a solitary old maid, the last of her family to be left in enjoyment of single blessedness. But you must bear in mind that none of this is true of the common purple clover, nor yet of the brilliant crimson kind (known to our farmers as "carnation trifolium"), both of which are distinct species with totally different marriage customs. The ingenious habit of turning the fertilized flowers downward out of the way of the insects is confined to a few species of white, pink, and yellow clovers. It is a little dodge on which they happen to have hit, but which has never occurred to their larger and more conspicuous red and purple cousins. So if you try to follow out these hints in nature, you must be careful to hunt for white kinds only.

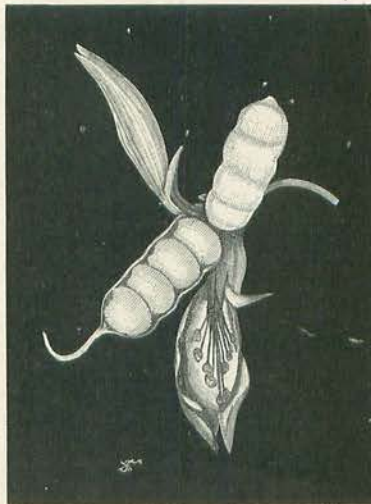
No. 10 shows us the last stage in the life-history of a head of Dutch clover. All the flowers have by this time been fertilized; even the solitary old maid has been made happy at last by some passing bee; and each flower alike is now pressed down against the stem in a crumpled, brown, and withered-looking mass. The mere casual observer would say, "This clover is dead." But it is nothing of the kind: it is only shamming. The main object of the flowering and fertilization, after all, is the production of seed; just as among birds the main object of pairing and nesting is the laying of eggs and the hatching of their little ones. And this introduces us to a second consideration of great importance. Plants not only marry, they take care of their young. The

seeds of clover are small, but they are rich in food-stuffs laid by for the use of the little plant at its start in life. Now, the parent flower is well aware that many insects love to lay their eggs and hatch out their grubs in pods of this character; if you have ever shelled peas, you must have seen such grubs very frequently in the peapods. The maternal instinct of the mother makes her lay her eggs where food is abundant; the maternal instinct of the mother-plant makes it do its best to protect its young against such devouring enemies.

In No. 11 we see a flower of Dutch clover cut open lengthwise, so as to show the little pod within, very much magnified, and with one valve opened. Tiny as these pods are, they usually contain two, three, or four seeds. Every kind of clover, owing to the richness of these seeds, is much exposed to the attacks of insect enemies. To baffle these wary foes, the clovers have invented an extraordinary variety of protective devices, two of which I mean to examine in this essay. Dutch clover meets the difficulty by tucking down the flowers after fertilization out of the way of the bee, and then retaining the withered corolla or set of petals which completely inclose and hide the pod in the centre. Indeed, such a head as you see in No. 10, all composed of brown and withered flowers, looks externally as if it were quite dead; but if you remove or cut open the sere and papery outer parts of the flower, you will find within them a vigorous little green pod, in which the miniature peas, after fertilization, are maturing actively. In fact, the plant is only pretending to be dead; yet so effective is the pretence, and so well does the papery covering guard each pod against the egg-laying insects, that I can-



10.—DUTCH CLOVER, ALL THE FLOWERS FERTILIZED, AND MATURING THE SEED.



11.—DUTCH CLOVER, ONE DRY FLOWER CUT OPEN TO SHOW THE POD AND SEEDS RIPENING.

not remember ever to have found a single grub in the seeds of clover. This may seem to you a small matter to guard against; but if you open the seed-capsules of the common little mouse-ear chickweed, which has no such protection, you will find in almost every capsule a small red grub busily employed in eating the seeds which the plant had laid by for the continuance of its species. It is thus a distinct advantage to the clovers in the struggle for life that they have invented devices which enable them to guard their embryo young from the assaults of insects.

Every species of clover which grows in England—and, as I have said, we have more than twenty of them—has some dodge of its own for thus protecting its growing pods and seeds from the grubs which would destroy them. I only propose, however, to examine in detail here one more of these dodges. We have in England another kind of clover, a good deal like Dutch clover at a casual glance, and commonly confounded with it by unobservant people, though, as we shall soon see, the habits and manners of the two kinds are in reality very different. The strawberry clover, as it is called, is a somewhat lower and smaller species than Dutch clover, which it resembles in its creeping stems and in its rich foliage. But the flowers are not separately stalked in the head, so that they cannot turn down after fertilization like those we have just been considering. Moreover, the stems and flower-heads are much hairier; and this difference is due to the two facts that the strawberry clover is smaller, and has a shorter tube than its Dutch relation. It would thus be easy for ants and other crawling insects to creep



12.—STRAWBERRY CLOVER, WITH FERTILIZING BEE.

up the stem and steal the honey, which is intended for the use of fertilizing visitors. To prevent this misfortune, and to keep its nectar for the regular customers, the strawberry clover produces a number of hairs on the stem, which baffle the ants, to whom such hairs are an impenetrable thicket. But you may ask, "Why are not ants just as good as bees for the clover?" For this reason: flying insects are mainly guided by sight and colour; they flit straight from one flower to another of the same species; and their heads are exactly adapted to the shape of the flowers, which in turn have modelled their tubes and organs on purpose to fit them. Ants and creeping insects, on the contrary, are attracted merely by the sense of smell: they notice scent of honey; they climb up all stems indiscriminately in search of it; they are bare-faced thieves with no organs adapted for carrying pollen; and as they go about in the most reckless fashion from one kind of plant to another, if they did ever by chance succeed in fertilizing a casual flower, they would produce, not true species, but monstrous and meaningless hybrids. Therefore, many plants protect themselves by endless devices against the crawling ants, just as obviously as they endeavour to allure the winged bees, beetles, and butterflies. I may add that the head of strawberry clover

is further protected against climbing insects by a number of lobed bracts at its base, which effectually disperse these thieving marauders.

While the strawberry clover is young and but recently opened, you might easily mistake it for a small and pinky specimen of Dutch clover. If you look closer, however, you will see that the petals are not so large, the tube not so deep, and the calyx much hairier. Nevertheless, as you may observe in No. 12, the hairs do not seriously get in the way of the bee during the stage when the flowers are just fit for fertilization. As soon as the bee has left the plant, however, something happens which is quite different to the turning down of the florets in Dutch clover. The calyx or little cup which incloses each separate flower begins to swell and inflate itself like a balloon or bladder. In No. 13 you can see the beginnings of this curious process; each calyx is slightly swelling round the tiny pod which it incloses. In Dutch clover, the pod is longer than the calyx, and the plant trusts for protection to the papery petals or corolla. But in strawberry clover, the calyx, after flowering, becomes very much inflated, thin, and netted; and in this state it completely incloses the growing pod. No. 14 illustrates an intermediate stage in the process, with a solitary old maid still unfertilized, and the other flowers larger and more inflated.

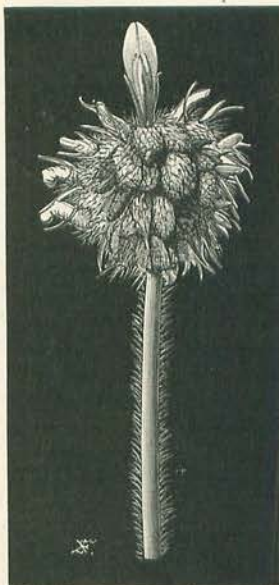


13.—STRAWBERRY CLOVER, BEGINNING TO SWELL.

In No. 15 the inflation is complete: each little calyx has now swelled out into a small balloon, inclosing its pod. The whole flower-head then becomes very compact, and assumes a pink tint, so that it somewhat resembles a strawberry, whence its ordinary name, though, as a matter of fact, it is much more like a raspberry. You will observe that the beautiful network-like head is closely covered with numerous hairs, which further help

to protect the pods from the attacks of insects.

The truth is, Dutch clover is a denizen of rich and lush meadows, where it can take care of itself, and for which alone it is perfectly adapted. Strawberry clover on the other hand has chosen its home in close-cropped pastures, where its creeping habit and low stature help to save it from destruction. The dry and hairy heads are not



14.—STRAWBERRY CLOVER, AGAIN AN OLD MAID.



15.—STRAWBERRY CLOVER, ALL THE FRUIT INFLATED.

relished by sheep, and you will often see them left uncropped where the neighbouring foliage has been closely nibbled. The swollen calyx with its hairs also keeps off egg-laying enemies. In No. 16 we have an illustration of one such fruiting flower, cut open lengthwise, so as to show the way the bladder-like calyx grows out around the pod as it ripens.

Now, what is oddest of all, every one of our

twenty or twenty-five English species of clover has some dodge of its own for protecting its seeds after fertilization. This shows how much these rich grains are sought after, and how carefully the plant is compelled to guard them. In some kinds, the calyx is a loose fluff of silky hair, inclosing the pod; in others, it is hard like a nut, or has stiff and pointed lobes which are sharp and prickly. One species closes its hardened lips over the growing seeds and pretends to be empty; a second develops a starry, thistle-like head, with tufts of thick hair, which conceal the swelling pod from observation. But the subterranean clover has hit upon a still stranger and more ingenious device. It is a little creeping annual, much addicted to dry pastures or close-cropped hillsides, and particularly common on low knolls or barrows, nibbled over by numerous sheep and donkeys. Under these circumstances, it has a hard fight to protect its nutritious seeds and seedlings. It has taken, therefore, to producing small heads of loose white flowers, which look at first sight like poor specimens of

Dutch clover.

But if you gaze closer you will see that each tiny head consists of two or three properly developed flowers, with four or five undeveloped or abortive blossoms in

the centre of the group. These undeveloped blossoms form a sort of living corkscrew. After fertilization, the stems bend down towards the ground; the corkscrew-like abortive flowers worm their way by pushing into the soil; the pods are pressed down or buried in the loose mould; and the plant thus sows its own seed for itself quite as effectually as a gardener could sow it. This is, perhaps, the furthest point which maternal solicitude has ever reached in the vegetable kingdom.



16.—STRAWBERRY CLOVER, A SINGLE INFLATED FLOWER CUT OPEN.