

one or more maggots, each in a small oval cavity or cell. Many of these deformities have the surface clothed with wool-like hairs, really modified and greatly developed plant hairs. This is carried to an extreme in the spherical masses of delicate, creamy-white hairs with pink spots caused by the wool sower. This mass, beautiful because of its wonderfully delicate tints and deceptively heavy, is really nothing but many deformed buds, each cell containing a maggot and united to those around by the greatly developed plant hairs. Some of the leaf galls, aside from the distinctly wooly ones, present extremely interesting modifications in that the plant hairs are modified to form more or less well developed spines, as for example in the yellow sea urchin and some of its allies, with their peculiar ornamentations and often striking coloration. A few galls show this development to an even more striking degree and are variously and sometimes grotesquely angled or spined. There is an apparently uninteresting succulent oak gall which is very deceptive since it is hollow and most remarkable of all the cavity contains a free rolling oval cell in which the gall maker is securely ensconced. It is literally a "high roller".

Nature delights in camouflage or mimicry. The cypress flower gall is a striking instance of this tendency to simulate even in places where nothing of the kind would be expected. The pretty little gall with its delicate tints, suggests for all the world one of the smaller flowers, despite the fact that it occurs upon cypress, a tree which produces no such flowers as are found among the other plants. This deformity is produced by a little gall midge and occasionally is so very abundant as to fairly dot good sized limbs with its pleasing combination of colour and form.

The relation of the gall insect to the plant upon which it subsists is worthy of careful consideration. The gall insects are fragile, minute and in many cases with restricted powers of flight, some even being wingless. Nevertheless, hosts of species manage to exist in the face of these limitations and in some cases it is known that a colony may remain year after year for a considerable series of years upon one or two relatively isolated bushes. A very considerable proportion of these gall insects must attack some part of the plant when it is growing rapidly, and usually in early spring when the tender tissues are literally rolling out of the buds and are in a most plastic condition. It is very probable that a considerable series of globular or variously shaped galls on the surface of leaves originate when the foliage is still in the bud. The wide scattering of some of these growths is simply due to the expanding tissues after the young gall insect has established

itself upon the developing leaf. But infestation is characteristic of a considerable series of gall midges, notably the peculiar forms producing variously shaped galls upon the surface of both hickory and oak leaves and as mentioned earlier, it is also true of a considerable series of the gall wasps. Were we to search carefully for an explanation of the peculiar alternation of generations mentioned above, we would probably decide that the appearance of this early spring, incomplete generation justified itself not only because all of the individuals were able to deposit eggs, but also on account of the fact that these eggs were deposited in the buds and therefore the young could develop under the best possible condition, due to the soft, plastic state of the leaves and catkins. In other words, alternation of generations is a modification which has enabled gall wasps to maintain themselves in large numbers, and an additional reason for believing this is seen in the fact that species presenting this marked deviation from what we usually find among gall insects are extremely abundant. It is one of the most striking of the numerous interrelationships occurring between insects and plants.

The mysterious and enchanting adaptations of gall insects are by no means completed with the above recital. Some of our plant lice exhibit equally interesting relationships. The galls of these insects are invariably recognized by the more or less distinct orifice and then there is usually a considerable cavity inhabited sometimes by one insect, frequently by more and occasionally the aphids are so numerous as to completely cover the entire interior so that a gall, when opened at this time, presents a striking resemblance in miniature to the geode. How is this strange modification brought about? Those who have studied louse galls state that in some cases at least, the parent insect simply establishes herself upon the leaf stalk, commences feeding and as a result of continued irritation, the plant appears to be compelled to develop an abnormal mass of cells which literally grows up and encloses its enemy. There is, of course, with this development of the plant, an increase in the number of the insects, so that eventually, conditions are as described above. Some of the jumping plant lice, rather closely related to the aphids just mentioned, are nearly as dependent upon hackberry as certain gall midges and gall wasps are upon oaks, and we find among these jumping plant lice not only a series of species upon a favored food plant but also an equally large series of galls, each with its peculiar structure, at least within certain limits.

These are not the only interesting relationships between insect galls and gall insects. There are also a number of species which take advantage of