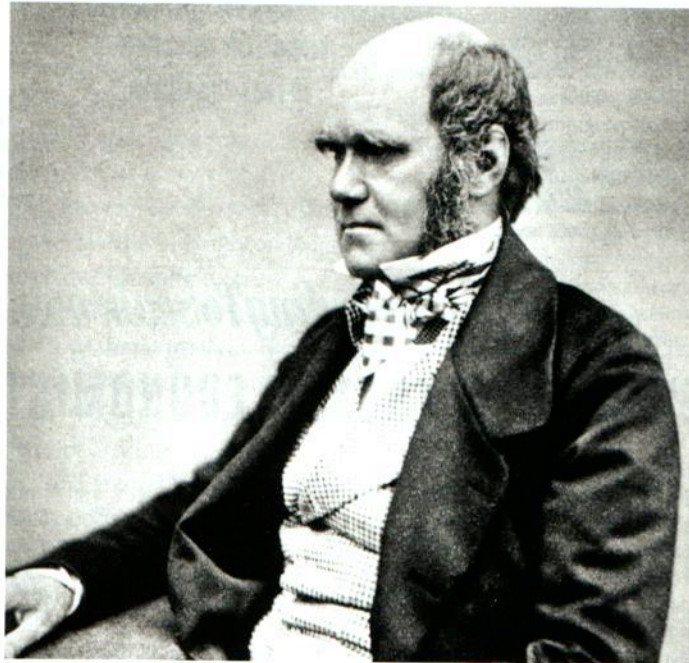


Darwin and the humble-bees

On 21 August 1841, Charles Darwin wrote to Horticulture Week forerunner The Gardeners' Chronicle about "the humble-bees which bore holes in flowers" following a reader's complaint about damage to his bean crop. Continuing celebrations of our 175th anniversary, here we republish Darwin's letter

“ Perhaps some of your readers may like to hear a few more particulars about the humble-bees which bore holes in flowers, and thus extract the nectar. This operation has been performed on a large scale in the Zoological Gardens: Near the refectory-house there is a fine bed of *Stachys coccinea*, every flower in which has one, and sometimes two, small irregular slits, or orifices, on the upper side of the corolla near its base. I observed some plants of Marvel of Peru, and of *Salvia coccinea*, with holes in similar positions; but in *Salvia Grahmi* they were without exception cut through the calyx, which is in this species elongated.

The tubular corolla of *Pentstemon argutus* is rather broader than in the above flowers, and two holes are always bored in it by the side of each other, and just above the calyx. All these orifices are so small that they might easily be overlooked; I first noticed them a week since, when, from the brown colour of their edges, they appeared to have been made some time before. The beds of *Stachys* and *Pentstemon* are frequented by numerous humble-bees of many very different kinds; at one moment I saw between 20 and 30 round a bed of the latter flower; they fly very quickly from flower to flower and always alight with their heads just over the little orifices, into which they most dexterously insert their proboscis and in the case of the *Pentstemon*, first into the orifice on one side and then into the other, so that they thus extract the nectar on both sides of the germen.



Darwin: offered readers 'a few more particulars about the humble-bees'

Besides the humble-bees, I saw some hive-bees on the *Pentstemon*; they were, however, much less dexterous and generally alighted across the flower, or on the calyx, and thus lost time. The orifices in all the above-mentioned flowers are made on the upper side of the corolla: I was therefore, surprised to find, close by, a large bed of the common *Antirrhinum* in which all the flowers had one or two irregular slits, or holes on the under side of the corolla at its base, close to the small protuberance which represents the spur in *Linaria*, and therefore directly in front of the nectary at the foot of the germen. From the

position of these orifices they cannot be seen without turning up the flower; but the humble-bees seemed to understand this method of picking pockets full as well as the other, and never hesitated where to go, but quickly flew from the under side of one flower to that of another.

Now I can speak positively, as far as the experiences of part two of summer goes, that country humble-bees are not so cunning, and invariably crawl into the flower by forcing open the elastic lower lip; and a very pretty spectacle it is to watch them. All the flowers of *Salvia Grahmi* and the *Antirrhinum*, which I looked at in different parts of the

garden, were bored; and out of the many hundreds in bloom in the two large beds of *Stachys* and *Pentstemon*, I could not find one without its little orifice, nor did I see one bee crawl in at the mouth. Nevertheless I found, and the fact appears to me very curious, two separate plants of the *Stachys coccinea*, and one large one of the *Pentstemon argutus*, with all their flowers unbored; from the scratches on the lower lip of the flower of two former plants I have no doubt that many bees had entered in the usual way, and I actually saw one bee crawling into the flowers of the *Pentstemon*. One is tempted to conjecture that in these plants each humble-bee as it came, not finding a hole ready cut, thought it less trouble to extract the nectar by the mouth than to make one; but that on the beds of the same flowers, where very many bees were rivalling each other in getting honey, some few set to work boring holes, and others copied the example.

From the comparative fewness of the hive-bees on the *Pentstemon* their evident awkwardness in finding the orifices, and the smallness of their mandibles, I can hardly doubt they were profiting by the workmanship and the example of the humble-bees; should this be verified, it will, I think, be a very instructive case of acquired knowledge in insects. We should be astonished did one genus of monkeys adopt from another a particular manner of opening hard-shelled fruit; how much more so ought we to be in a tribe of insects so pre-eminent for their instinctive faculties, which are generally

made the subject of elaborate calculation, which the imperfections and uncertainties of the practical details render of little value. The following, as a general rule, will be found, perhaps, as good as if it were demonstrated by algebraic formulae.—Take the cubic contents of the house, and for half-hardy plants give to every 100 feet 10 square inches of boiler-surface and one square inch of fire-grate. For tropical plants double these proportions, and for forcing-houses take intermediate proportions, according to the temperature required.—*A. Singer.*

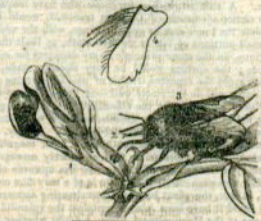
P.S. A correspondent of the *Chronicle* (July 10th) has criticised the charge of "wastefulness" applied to air-heating; it may therefore be necessary to say, that air-heating was called "wasteful" only as being more costly than radiant heat; and it was presumed to be less favourable to the perfect development of plants, because radiant heat was thought more nearly to resemble nature. It may be perfectly true, nevertheless, that flowers forced in a skilfully-controlled atmosphere, even of heated air, were as fine as any exposed to out-door cultivation in such a climate as ours. The real question, is whether they would not have been produced better, and cheaper by the use of radiant heat.

ENTOMOLOGICAL.

No. XII. HUMBLE-BEES.—Does the gardener know why his Broad-beans have not produced a fair crop this summer? if not, we can inform him. When the beans were in full flower towards the end of May, my attention was called to the injuries they had sustained in the horticultural gardens from the attacks of bees. More than three-fourths of the blossoms at that time had been perforated on the upper side of the calyx, near the centre or a little towards the base (fig. 2.), and likewise through the upper lobe of the flower; and this was the ingenious contrivance of the humble-bee to get at the honey contained in the nectary, and which they effected very readily by nibbling with their strong mandibles (fig. 1.) through which

we have heard of the Honey-suckle being subject to similar injuries.

It may be remarked, that all the leaves of the Broad-beans of the crop first alluded to, had the edges indented, and they exhibited the same appearance last week, but I am ignorant of the animal that has caused this strange appearance; it is possible that it may be the work of woodlice or of earwigs, and I shall be glad if any one will confirm or set me right on the subject; for as it is presumed to be a nocturnal operation, I have not the opportunity of settling the question.—*Hurlock.*



COTTAGE GARDENS.—No. XXVII.

There are none of our common fruits so universally esteemed as the Strawberry. It is regarded alike by the peer and the peasant as a delicious luxury, and not the least of its many recommendations is that, if managed with very little more than an ordinary share of attention, it is capable in some soils of being brought to as great perfection in the cottage garden as in any of our first-rate establishments.

Gardeners' Chronicle correspondent: reader complained about bean crop damage

supposed to be in inverse proportion to the intellectual.

Moreover, from what I have above stated regarding the *Antirrhinum*, I much suspect that the practice of boring holes in its flowers is likewise a piece of acquired knowledge whether the humble-bees do it instinctively or not in other cases. Although I have said that country humble-bees appear to be less cunning than London ones, yet I confess I saw this June, in Staffordshire, some in the act of cutting holes at the base of the corolla of the *Rhododendron azaleoides*; the greater number entered the mouth of the corollas, as indeed was evident from the quantity of pollen on the stigma, brought by the bees from neighbouring azaleas—this hybrid not having a single grain of pollen of its own. One bee was seen which entered the mouth of some of the flowers and cut holes in others; this shows that the orifices are made simply to save trouble, and not because the bee cannot extract the nectar from the long tube.

In the *Stachys* and *Pentstemon* it is also evident that the bees cut the holes because they can fly much quicker from the upper surface of one flower to that of another, than clamber in on the fringed edge of the lower lip. I have no doubt by this means they are able to visit twice the number of flowers in the same time. Your correspondent (p485) says that the Honey-suckle is sometimes bored. I never happened to notice this, but I have seen pollen-gathering humble-bees show much skill in forcing open the yet-closed mouth of

the young flowers and extracting the pollen; flowers which had been open, apparently even for a day, they at once passed over, whereas the nectar-seeking humble-bees stopped at them. If the mouth of the flower was absolutely close, without any one segment having started, the bees from the difficulty of the attempt immediately gave it up.

Your correspondent attributes the failure of his Bean-crop to the apertures made by the bees: but when we remember how the petals of many flowers may be manipulated in hybridizing them, without preventing their fructification, we may well doubt this view. But I conceive they may be indirectly the cause of the crop failing, not by their making the orifice, but by their not extracting the nectar in the manner nature intended them; for I have observed that when papilionaceous flowers are mature (and actually in the case of the bean) bees alighting on the wing-petal, as they always do to reach the nectar at the base of the standard-petal, depress the wing petals together with the keel, by which movement the grains of pollen together with the stigma are forced out, and both rubbed against one side of the bee's body, already generally well dusted with the pollen

‘Although I can believe that such wicked bees may be injurious to the seedsman, one would lament to see these industrious, happy-looking creatures punished with the severity proposed by your correspondent’

the included granules of pollen! I will only farther remark, that after the facts here noticed, one may well doubt C. K. Sprengel's view, that the streaks and spots of colour (saft-maal) on the corolla of most nectariferous flowers, serve as guides to insects, that they may readily find out where the nectar-vessel lies. I think the bees which flew so quickly from flower to flower on the under sides of the *Antirrhinum*, or those which bored the pair of holes on the *Pentstemon*, or those which bored through calyx and corolla in the *Salvia*, would tell Mr. Sprengel, that although he might want such aids, they did not. I know hardly any flower which bees open and insert their proboscis into, more rapidly, than the common tall *Linaria*, which has a little purplish well-closed flower; I have watched one humble-bee suck twenty-four flowers in one minute; yet on this flower there are no streaks of colour to guide these quick and clever workmen.—*C. Darwin.*

Strawberries.—What is here called the Elton, or Elton Pine, is reckoned superior to the Downton; it re-

Darwin's response: countered view crop failure was due to bee-made apertures

of other flowers of the same species. If all those flowers, even hermaphrodite ones, which are attractive to insects, almost necessarily require their intervention, as is supposed with much probability by Christian Spengel (Entd. Geheim.), to remove the pollen from the anthers to the stigma, what unworthy members of society are these humble-bees, thus to cheat, by boring a hole into the flower instead of brushing over the stamens and pistils, the so imagined, final cause of their existence!

Although I can believe that such wicked bees may be injurious to the seedsman, one would lament to see these industrious, happy-looking creatures punished with the severity proposed by your correspondent. Moreover, the florist, I believe, ought rather to praise them for this ingenious method of obtaining the nectar, instead of by the old-fashioned natural one; for let him look how torn and scratched the lower petals of some flowers are—for instance, those of the *Mimulus roseus*, and the wing-petals of some *Everlasting-peas*. The little orifice which the bees make, in order to avoid clambering in at the mouth, is hardly visible; whereas all the flowers in some beds of the *Mimulus*

at the Zoological Gardens are sadly defaced. Let any one who doubts the use of bees in the fructification of hermaphrodite flowers, watch and admire the manner in which the flat surface of the divided stigma of this *Mimulus* licks the back of the entering bees, which is generally well dusted already with pollen; and then how admirably the two divisions of the stigma, endowed with a sensitive faculty, close like a forceps on the included granules of pollen!

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● Taken from *The Gardeners' Chronicle*, 21 August 1841.