Drone Congregation Areas

OR DRONE ZONES

'There is a natural occurrence to be met with upon the highest part of our down on hot summer days, which always amuses me much, without giving me any satisfaction with respect to the cause of it; & that is a loud audible humming of bees in the air, tho' not one insect is to be seen. This sound is to be heard distinctly the whole common through, from the Moneydells, to Mr White's avenue-gate. Any person would suppose that a large swarm of bees was in motion, & playing about over his head. This noise was heard last week on June 28th.'

GILBERT WHITE, 'A NATURAL HISTORY OF SELBORNE', 1792

The above writing is believed to be the earliest known reference to what we now call a drone congregation area (DCA). Although a lot of research has been carried out into drone behaviour in DCAs, no one has yet satisfactorily explained why the DCAs occur in certain places, and even more mystifying, why they persist in the same places year after year. The DCA referred to by Gilbert White is still in use today.

Virtually all drones die in the previous autumn, so how do the new drones know where to go? Light distribution and the contour of the horizon seem to play a part in choosing a site *(Pechhacker 1994)* and Zmarlicki and Morse determined that most DCAs seem to be located over an open area of land of about a hectare, protected from strong winds. Obstructions such as high buildings and tall trees are avoided, but not all open spaces are used. The flyways connecting the DCAs tend to follow lines of trees or hedges, etc. There may be several DCAs adjacent to each other. One study showed that a 10 sq k. area next to an commercial apiary contained at least 26 DCAs and 18km of flyways. Based on radar images a DCA was defined as an area approx. 100m in diameter, where the drones fly at a mean height of 25m-it depends on wind velocity. The stronger the wind, the lower the drones fly.

Many drones seem to stay faithful to one DCA, but may visit another in the same general direction. Two to three miles seems to be an average distance for a drone to fly, but they have been known to travel up to 5 miles. For a queen rearer wanting pure matings from a mating apiary, it seems that this is the minimum distance there must be from any other hives, or else a physical barrier of 500m or more must be present. The parentage of a sample of drones was tested in Germany in 1998, and the conclusion reached was that all the colonies in the area seemed to send roughly the same proportion of delegates to the meeting, thus minimising the chances of inbreeding. *(C.Collinson, Bee Culture, Sep. 2008)* Because mating takes place in flight, it is difficult to observe.

Modern technology such as radar, combined with the technique of tethering a virgin queen to a moving line, has shown drones detecting a virgin forming a long comet- shaped tail behind her. Recent studies have shown that the drones find the virgin primarily by smell. One of the components of queen substance, called 9-ODA, attracts drones during mating flights. *(Apis UK, July 2008).* However, it has also been noticed that drones will momentarily chase anything that moves, butterflies, dragonflies or a thrown stone, so presumably eyesight plays a part as well.

Drones have to be very fit and well developed to mate with a queen. In addition to the excellent flying power needed to catch the queen, they must have ample supplies of spermatazoa, as only a fraction of each ejaculate will migrate to the queen's spermatheca. *(Woyke and Jasinski, 1973)* In a series of studies made by Duay et al, in 2002, it was shown that the effects of parasitism by Varroa destructor in the larval stage, could seriously affect the drones ability to mate. A significant reduction in drone body weight resulted from invasion by only one female varroa mite, and two or more mites reduced drone life expectancy so much that sexual maturity was seldom reached. Varroa parasitism by only one mite hardly affected flying power but sperm production was reduced by 24%. In those drones that survived, two female mites invasion resulted in greatly reduced flying power and a sperm reduction of 45%.

OTHER INTERESTING FACTS TO EMERGE ARE . . .

1 Drones like it hot. Flying to a DCA and gathering enough drones to form a comet only occurs at 18C or above.

2 They are very good time keepers, generally flying between 2.00pm and 6.00pm This varies according to the weather.

3 Drones returning to the apiary outside these times were not interested in a queen.

4 Maximum flight height in flyways is 21m, but in DCAs it can reach 50m.

5 Drones can make several trips to a DCA in an afternoon, returning to the hive to refuel when necessary. Each mating flight lasts about 30 mins.

6 The number of drones in a DCA can vary enormously, from hundreds to thousands.

7 Usually, 7 to 11 drones will mate with a queen. About 90 million sperm will be deposited in her oviducts, and a mixture of about 7 million of them will be stored in her spermatheca

MATING.

The actual process of mating has now been documented quite thoroughly. drone mounts a queen and inserts his endophallus and ejaculates his semen. During ejaculation he falls backwards and his endophallus is torn from his body, remaining in the queen. Any subsequent males mating with the queen dislodge the previous drones endophallus and leave their own in its place. The drones die quickly with their abdomens ruptured in this fashion. The queen returns to her hive still carrying the endophallus of the last male to mate with her. Beekeepers call this the *'mating sign'* It will be removed by the nurse bees. The process is described very clearly in *'The Biology of the Honeybee'* by Mark Winston.

THE DOWN-AND-OUT.

Once the mating season is over, the *'raison d'etre'* of the drones is gone. Only in queenless or very well provisioned colonies will some be allowed to overwinter in the hive. There is no sentimentality in nature, and drones with no function to perform are simply a drain on valuable resources, ie honey stores. In the autumn they are refused entry to the hive, or have their wings bitten and are forcibly ejected, to die of cold and starvation.

NOTE FROM EDITOR . . .

And why is understanding of drone behaviour so important? Understanding drones may well be the key to controlling varroa. Drones range over a 5 mile radius. Workers range over a 3 mile radius. Drones are tolerated, even welcomed in strange hives. Worker bees are prevented from entering starange hives unless they have a full load of honey. For the varroa mite to spread it needs to defferentially lay in drone cells . This behaviour has evolved within the primary host/parastite, that of *apis cerana*/Varroa destructor. Those who keep the Honey Bee, *Apis melifera,* have long noticed the preference for varroa to lay in drone cells. This has lead to the destruction of drone cells becoming an indicator of varroa infestation . Stimulation of the queen to lay whole frames of drones which are then destroyed is now a regular part of Integrated Pest Management.