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OBSERVATIONS ON COLONY SIZE IN BUMBLEBEES (*BOMBUS* SPP.)

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One factor to consider when attempting to rear bumblebees (*Bombus* spp.) for pollination of crops is potential colony size. Species which emerge from hibernation early and continue to produce workers late in the summer or early fall are likely to have larger colonies. In contrast, Arctic species such as *Bombus polaris* Curtis and *hyperboreus* Schönherr may produce only one brood prior to the sexual brood. Richards (1973) reported that colonies of *polaris* are smaller than colonies of species from lower latitudes in North America. Hobbs (1967) estimated 772 as a maximum colony size for *huntii* Greene in southern Canada and over 3,000 bees per colony, based on data from Medler (1959), for *huntii* found in New Mexico. *B. medius* Cresson in Mexico may reach the same number (Michener and LaBerge, 1954). Dias (1958) reported a potential of 3,056 *incarum* Franklin from Brazil. Thus, it would appear that under optimum conditions several species from the western hemisphere have sufficient potential colony size for successful semi-domestication for crop pollination.

Hasselrot (1960) reported a maximum potential colony of 1,474 for *terrestris* (Linnaeus) in Sweden. Holm (1960) obtained an average of 316 bees per nest in 35 nests of *terrestris* and *lapidarius* (Linnaeus). Katayama (1965) estimated a maximum of 563 *diversus* Smith in Japan. Nests collected from natural sites seldom contain more than 400 bees in all stages or more than 200 adult bees. The average number is much less than the numbers obtained by Hasselrot, Holm, or Katayama. These higher numbers are due in part to the calculation of colony size from numbers of cells and eggs.

Twenty three nests of five species were collected in southern Michigan between 1963 and 1966. The number of adult bees per nest is given in Table 1. The average number of bees per nest was 72. The only underground nest was that of *affinis* which contained 227 bees.

An underground nest of *impatiens* Cresson was collected on August 26, 1975, about 2 miles west of Adrian College adjacent to a field behind the home of Roger Hopkins. The total of 756 active bees represents the largest number of adult bees reported from a single nest in the United States.

The nest was near the margin of a field of tall corn. One of the tunnel openings to the nest was about 1 foot from the field margin. Another opening was about 3 feet away near a seldom-used path. The bees were collected between 10:00 and 12:00 at night by thumping the ground and picking the bees up as they exited the tunnels. When no more bees exited, a shovel was used to take off the dirt in layers. The soil was quite firm and the tunnels did not collapse. The main part of the nest appeared to be about 1 foot in diameter and may have been produced originally by a meadow vole (*Microtus pennsylvanicus* Ord). Clippings of grass in the nest resembled those often found piled in meadow vole runways. Some cells were found in tunnels adjacent to the cavity which contained the nest. The nest was about 18 inches underground. All of the bees and the nest were placed in a freezer prior to examining the nest for numbers of pupae, larvae, workers, queens and males. The final count yielded 465 workers, 241 males and 50 queens. In addition, 235 larvae and pupae presumed to be queens and 150 larvae and pupae presumed to be males were collected. Some pupae were sufficiently developed to be recognized, while other pupae and the larvae were identified on the basis of size. No workers were among the recognizable pupae. Since neither eggs nor pupal or larval stages of workers were found, the total number of 1,151 may be near the maximum reproductive potential of this species. Franklin (1912) reported 340 adults plus 330 unbroken cells for this species; Plath (1922) reported a nest of "over 450" workers.

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Table 1. Number of adult bumblebees per nest of five species collected in southern Michigan.

Species	Number of adults per nest
affinis	27, 227
americanorum	15, 23, 30, 42, 46, 63, 81, 81, 83, 93, 120, 170
bimaculatus	95
fervidus	37, 44, 126, 146
griseocollis	11, 22, 23

Table 2. Number of living stages of bumblebees per nest.

Species	Queens	Males	Workers	Larvae	Pupae	Eggs	Total
incarum, Brazil	35	56	473	815	652	1025	3056
medius, Mexico	1	0	800	154	1	28	984
huntii, New Mexico	1	0	515	101	236	308	1161
impatiens, Michigan	50	241	465	93	292	9	1141

The nest of *huntii* from New Mexico reported by Medler (1959) contained 516 adult bees plus 1,354 eggs, larvae, and pupae. The nest of *medius* from Mexico reported by Michener and La Berge (1954) had 1 queen, 800 workers, 28 eggs, 126 larvae and 1 pupa. The nest of *incarum* from Brazil reported by Dias (1958) had 564 adult bees plus 2,492 eggs, larvae and pupae. These data are summarized in Table 2.

Cumber (1949) and Brian (1951) indicate that about 1/3 of the eggs laid by a queen will develop into adult bees. The highest mortality is during the egg stage. Thus, estimates of 3,000 bees per colony for *huntii* and *incarum* may be too high. Colonies of 1,000-2,000 might be expected under optimum conditions.

If a large number of colonies of desirable species could be maintained, better seed yields of leguminous crops such as red clover might be expected. Some species might be ultilized for pollination of backyard orchards and gardens in cities where apiaries of honeybees might be objectionable or unnecessary for the small crops produced. Several species of bumblebees, including *huntii* and *impatiens* in the United States, have sufficiently large colonies to have potential for semi-domestication and usefulness for commercial crops or for the home gardner.

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