

*Journal of Apicultural Research* 12(3) : 187-190 (1973)

## PREFERENCE FOR SOME OTHER POLLENS SHOWN BY LINES OF HONEYBEES SELECTED FOR HIGH AND LOW ALFALFA POLLEN COLLECTION\*

OTTO MACKENSEN and SHIRLEY C. TUCKER

*Bee Breeding Investigations, Agricultural Research Service, U.S.D.A. and Department of Botany, Louisiana State University, Baton Rouge LA 70803, U.S.A.*

*Manuscript received for publication 13th November 1972*

### Summary

The collection of pollen by high and low alfalfa pollen collecting lines of honeybees was studied at Baton Rouge, Louisiana, where no alfalfa (*Medicago sativa*) is grown. The high line collected significantly more pollen than the low line from *Trifolium repens*, *Cornus drummondii*, *Ampelopsis arborea*, *Polygonum* spp., *Lippia lanceolata* and *Geranium carolinianum*. The low line collected significantly more than the high line from *Tradescantia bracteata*, *Rhus radicans*, *Ambrosia* spp. and *Solidago* spp. Twenty-four pollen sources were studied.

### Introduction

Mackensen and Nye (1966) reported that the tendency for some honeybees (*Apis mellifera*) to collect more pollen than others from alfalfa (*Medicago sativa*) was inherited, and they established high and low alfalfa pollen collecting (APC) lines. The question then arose as to whether these lines collected different amounts of other pollens, and especially whether the high APC line had a preference for other legumes such as white clover (*Trifolium repens*). Data reported by Louveaux (1954) suggested that the answer might be positive, since colonies that collected the highest percentage of pollen from rape (*Brassica napra*) and turnip (*B. rapa*) in April were also more interested than others in collecting the pollen of field mustard (*Sinapis*), despite the 10-day interval between the flowering periods of the *Brassica* species and that of field mustard. On the other hand, Nye (1971) found no difference between the high and low APC lines in amounts of pollen collected from alsike clover (*Trifolium hybridum*). The work reported here was made to test further the pollen preferences of the APC lines in an area where alfalfa pollen was not available.

### Materials and Methods

The study was made in 1966 and 1970, at the Bee Breeding Investigations Laboratory at Baton Rouge, Louisiana, in a suburban area where woods, pasture, agricultural crops, and garden plants were within flight range. In 1966, six colonies each of the high and low APC lines were tested for pollen preferences during the spring (31st March to 11th June). These lines had been selected for four generations, with some inbreeding, which had reduced brood viability and populations; the colonies tested were of about equal strength. The colonies of the high line had collected an average of 77.8% alfalfa pollen at Logan, Utah, the previous year, and the low line colonies an average of 3.3%.

---

\* In co-operation with Louisiana Agricultural Experiment Station.

In 1970, six colonies of each line were tested for pollen preferences in the spring (23rd April to 2nd July) and nine colonies in the fall (31st August to 30th October). The low line had been selected for four more generations without outcrossing, and the colonies were of about the same strength as those tested in 1966. In the meantime the high line was outcrossed and backcrossed, resulting in higher brood viability and greater populations than in the low line.

In 1966 the colonies were located in a grove of trees about 2 m apart, in a row with the high line colonies at one end and the low line colonies at the other end. Since these colonies were not randomized, drifting of worker bees among them might have influenced the results. However, we consider drifting a negligible influence because the area was well provided with trees, shrubs and buildings that could be used as landmarks by returning foragers, and only an occasional bee was found out of place where colonies of the two lines were in close proximity. (The bees of the two lines were distinguishable by body colour.) In 1970 the colonies were placed at random in the same general location.

Pollen was collected with pollen traps so constructed that they could easily be changed either to permit returning bees to enter the colony uninhibited or to force them to pass through the grid for pollen collection. Collections were made from each colony for an entire day about twice a week in 1966 and three times a week in 1970, weather permitting. The traps were set for collection from early morning to late afternoon or, when this was not convenient, from late afternoon one day to the same time the following day. The collected pollen was stored at  $-18^{\circ}\text{C}$  until it could be sorted.

In the 1966 test a 2.5 g sample of pollen was taken from each collection; in the 1970 test this was increased to 3 g. The pellets were separated under white light by colour, size and texture, and then if necessary by grain size and shape under a stereomicroscope at  $50\times$  or higher magnification. Temporary microscope slide mounts of pollen grains in glycerine were used to determine the completeness and accuracy of the separation. The sorted pollens were then weighed separately. Plant sources were identified by comparing the temporary mounts, and other permanent mounts prepared by acetolysis and mounted in glycerine jelly, with similar mounts of pollen taken from flowers. Many pollens were identified. Those not included here occurred in small quantity, or could not be separated with sufficient certainty because of similarity of pellets and/or grains.

The data were treated statistically by analysis of variance.

## Results and Discussion\*

The percentages, by weight of the various pollens collected by the two lines are given in Table 1 and Table 2. The entries for either line add up to more than 100% because only those plants represented in a pollen sample for any one date were included in calculating the percentages for that date. In 1966 (Table 1), the difference between the weights of pollen collected by the two lines was significant ( $P < 0.05$ ) for only two plant sources: *Rhus radicans* and *Geranium carolinianum*. The low APC line collected the greater amount of the *Rhus* pollen and the high APC line the greater amount of *Geranium* pollen. There was a significant variation among colonies within lines for *Rubus* spp., *Salix* spp., *Trifolium repens*, *Tradescantia bracteata*, *Rhus radicans*, *Magnolia grandiflora* and *Geranium*. With the exception of *Eucalyptus*

---

\* Common names of all plants are included in Table 1 and Table 2.

TABLE 1. Mean percentages of pollen collected from 12 plants by colonies of the high and low APC lines (1966).

| Plant source                                 | Mean percentage |          | No. collection dates |
|--|-----------------|----------|----------------------|
|  | High line       | Low line |                      |
| <i>Rubus</i> spp. (dewberry, blackberry)     | 24.5            | 22.0     | 8                    |
| <i>Salix</i> spp. (willow)                   | 13.4            | 10.2     | 5                    |
| <i>Trifolium repens</i> (white clover)       | 29.1            | 28.6     | 18                   |
| <i>Verbena brasiliensis</i> (vervain)        | 14.8            | 25.9     | 5                    |
| <i>Lonicera japonica</i> (honeysuckle)       | 2.1             | 0.9      | 4                    |
| <i>Tradescantia bracteata</i> (spiderwort)   | 3.9             | 6.3      | 15                   |
| <i>Rhus radicans</i> (poison ivy)            | 14.2            | 25.8*    | 5                    |
| <i>Magnolia grandiflora</i> (magnolia)       | 24.4            | 13.9     | 11                   |
| <i>Eucalyptus rudis</i> (eucalyptus)         | 6.9             | 6.2      | 2                    |
| <i>Rudbeckia amplexicaulis</i> (coneflower)  | 3.7             | 2.0      | 9                    |
| <i>Sonchus asper</i> (sowthistle)            | 0.7             | 0.9      | 5                    |
| <i>Geranium carolinianum</i> (wild geranium) | 1.8             | 0.5*     | 4                    |

\* Difference significant at the 5% level of confidence.

*rudis* and *Rudbeckia amplexicaulis*, the variation due to date was significant; this was due to changes in weather, and natural increase and decrease in the availability of bloom as the season advanced. For many plants the interaction between dates and lines was not significant (*Rubus* spp., *Salix*, *Rhus*, *Magnolia*, *Eucalyptus*, *Rudbeckia*), and the percentage of pollen collected from the plant tended to rise and fall simultaneously in the two lines.

TABLE 2. Mean percentages of pollen collected from 18 plants by colonies of the high and low APC lines (1970).

| Plant source                                      | Mean percentage |          | No. collection dates |
|---|-----------------|----------|----------------------|
|   | High line       | Low line |                      |
| <i>Trifolium repens</i> (white clover)            | 50.7            | 32.7**   | 36                   |
| <i>Cornus drummondii</i> (roughleaf dogwood)      | 23.2            | 11.1**   | 10                   |
| <i>Tradescantia bracteata</i> (spiderwort)        | 1.0             | 3.9**    | 18                   |
| <i>Rhus radicans</i> (poison ivy)                 | 13.2            | 22.2**   | 22                   |
| <i>Magnolia grandiflora</i> (magnolia)            | 8.4             | 7.2      | 19                   |
| <i>Eucalyptus rudis</i> (eucalyptus)              | 21.9            | 27.2     | 7                    |
| <i>Rudbeckia amplexicaulis</i> (coneflower)       | 1.0             | 0.7      | 13                   |
| <i>Sapium sebiferum</i> (tallow tree)             | 26.4            | 28.6     | 10                   |
| <i>Amelopsis arborea</i> (peppervine)             | 13.8            | 1.2**    | 9                    |
| <i>Sorghum halepense</i> (johnson grass)          | 27.0            | 45.6     | 8                    |
| <i>Lagerstroemia indica</i> (crepe myrtle)        | 26.3            | 19.2     | 7                    |
| <i>Polygonum</i> spp. (heartsease)                | 17.9            | 9.1**    | 20                   |
| <i>Lippia lanceolata</i> (South American vervain) | 8.2             | 1.0**    | 8                    |
| <i>Ambrosia</i> spp. (ragweed)                    | 7.0             | 15.2*    | 9                    |
| <i>Cassia chamaechrista</i> (partridge pea)       | 23.4            | 32.1     | 10                   |
| <i>Diodia virginiana</i> (buttonweed)             | 2.4             | 4.1      | 10                   |
| <i>Aster</i> spp. (aster)                         | 48.3            | 39.3     | 13                   |
| <i>Solidago</i> spp. (goldenrod)                  | 13.4            | 24.4**   | 10                   |

\* Difference significant at the 5% level of confidence.

\*\* Difference significant at the 1% level of confidence.

Although the percentages of *Trifolium repens* pollen collected by the two lines during the entire collection period were about the same, the high APC line consistently collected more than the low APC line on the eight dates from 20th April to 20th May (51% and 26%, respectively) and consistently less on the six dates from 25th May to 11th June (16% and 45% respectively).

In the 1970 data (Table 2) the difference between the amounts of pollen collected by the two lines was significant ( $P < 0.05$ ) for *Ambrosia* spp., and highly significant ( $P < 0.01$ ) for *Trifolium repens*, *Cornus drummondii*, *Tradescantia*, *Rhus radicans*, *Ampelopsis arborea*, *Polygonum* spp., *Lippia lanceolata* and *Solidago* spp. In nearly every case the variation among colonies within lines and among dates was highly significant. The interaction between dates and lines was not significant for *Eucalyptus*, *Rudbeckia*, *Lagerstroemia indica*, *Cassia chamaechrista*, *Diodia virginiana* and *Solidago*. Therefore, the percentage of pollen collected from these plants rose and fell simultaneously in the two lines.

Apparently there are real differences in the pollen-collecting habits of these two lines of bees, in addition to the difference in their collection of alfalfa pollen. The low line collected significantly more *Rhus radicans* pollen in both years. It also collected more *Tradescantia* pollen in both years, although significantly more only in 1970. The high line collected significantly more *Trifolium repens* pollen only in 1970. In 1966 it collected more than the low line only during the first part of the test period. It also collected more, but not significantly more, *Rudbeckia* pollen in both seasons. So there is some sign of consistency in the specific pollen-collecting activity of both the lines over the two years. The fact that the lines had been selected for alfalfa pollen collection through four more generations might account for the greater number of significant differences in 1970.

## References

- LOUVEAUX, J. (1954) Études sur la récolte du pollen par les abeilles. *Apiculteur* 98(12): 43-50
- MACKENSEN, O. & NYE, W. P. (1966) Selecting and breeding honeybees for collecting alfalfa pollen. *J. apic. Res.* 5(2) : 79-86
- NYE, W. P. (1971) Pollen collection from alsike clover by high and low alfalfa pollen collecting lines and by a commercial line of honeybees. *J. apic. Res.* 10(3) : 115-118