APPENDIX 10. PRELIMINARY ANALYSIS OF DATA RECEIVED
FROM 26 JULY 1985 TO 31 DECEMBER 1986

Summary

Preliminary analysis of the data has yielded the following information:

1. Identification of all plants flowering at the experimental sites to provide check lists of both Latin and Bangla names. (A few plants still awaiting identification are listed under their Bangla names only.)

Identity records of the honeybee species visiting each bee forage plant and the forage collected.

The identity of those plants which do not appear to attract honeybees for forage, the production of a check list of their Latin names and their elimination from the project.

2. Estimation of the relative abundance at each experimental site of each plant on which Apis cerana foraged in the rice-growing area around Dhaka.

3. Construction of a preliminary bee forage/floral calendar for the most abundant plants utilized by A. cerana.

4. Tabulation of the numbers of Apis cerana foragers collecting nectar and/or pollen from the most abundant bee forage species.

Estimation of their relative attractiveness to A. cerana.

5. Tabulation of the numbers of A. cerana foragers returning to their hives with nectar and pollen loads throughout the year, and the production of a graph of the results for one site with diagrammatic representation for one of the sites.

6. Analysis of the pollen grains present in samples of honey from Bangladesh.

7. Comparison of relevant information available in the library at IBRA on bee forage in countries bordering Bangladesh has been instigated.

Colony data sheets and weights of honey extracted from the hives at the five sites, arrived during February 1987, and were too late to be included in this report.
Experimental methods

The experimental methods used when collecting all data and details of the site data sheets are given in the second six-monthly report on the project.

Results of analysis

1. Plants used as forage by Apis cerana, A. dorsata and A. florea at the five sites

Since July 1985, 216 plant species have been identified, and a further 47 (known only by their Bangla names) are awaiting identification at the Bangladesh National Herbarium (Appendix 3).

Of these 263 plants, 124 are known so far to be visited for nectar and/or pollen by the honeybees Apis cerana, A. dorsata and A. florea. These bee forage plants are listed in Appendix 8, together with records of nectar and pollen collection by the three honeybee species.

Plants which when flowering do not appear to attract honeybees are listed in Appendix 6.

2. Analysis of the relative abundance of plants foraged by A. cerana in the Dhaka area

Using the data sheets completed by Latif Dewan from 26 July 1985 to 31 December 1986, Tables 1-5 have been constructed. These Tables summarize all the data collected on the foraging of A. cerana between these dates and, together with Appendix 8, show that 81 plant species are visited for nectar, pollen or both.

In order to assess their relative abundance in the Dhaka area, the forage plants were assigned to groups according to the number of sites at which they were present:

- **Group 5**: Plants present at all five sites
- **Group 4**: Plants present at four sites
- **Group 3**: Plants present at three sites
- **Group 2**: Plants present at two sites
- **Group 1**: Plants present at only one site

The plants in each group are listed in Table 6. Of the 81 plant species, 12 are present at all five of the experimental sites and can therefore be regarded as common in the Dhaka area. All further preliminary analysis concentrates on these 12 species; the plants in the other four groups will be dealt with at a later date.

Relative abundance of Group 5 plants at the experimental sites was estimated on a scale from 1 to 5, 1 being scarce and 5 abundant. The abundance ratings for the twelve Group 5 plant species are shown in Table 7.

Litchi and Zizyphus, although abundant in the Dhaka area, were rated as scarce at some sites (Table 7).

3. Preliminary bee forage/floral calendar for A. cerana: Group 5 plants

Field data sheets and Tables 1-5 were used to construct a preliminary bee forage/floral calendar (Table 8).
Three of the plants (Amaranthus, Cocos and Musa) flowered almost continuously throughout the year, whereas the other nine species had much shorter flowering periods. Although some Group 5 plants flowered during each month of the year, there appeared to be a dearth period from mid April to early October, when fewer species were in bloom. Table 8 also shows whether bees were collecting nectar, pollen or both.

4. Numbers of foragers collecting nectar and/or pollen from Group 5 plants

Table 8 gives no indication of the numbers of foragers present on the flowers during each observation period. Using the information in Tables 1-5, Tables 9-13 were prepared to give the numbers of foragers collecting nectar only, pollen only, or both nectar and pollen during each observation period. Table 14 gives the combined results (all sites) for one year and also the percentage of foragers collecting pollen.

By far the greatest numbers of nectar foragers were observed on Brassica (838) and Litchi (418). Moringa and Musa attracted 176 and 104 nectar foragers respectively, whereas Amaranthus and Bombax appeared to be very poor sources of nectar with only two nectar foragers observed on each of them.

Pollen gatherers were commonly observed on Brassica (345), Citrus (257), Cocos (365) and Bombax (240), whereas the other eight plants in this group were poor pollen sources, with Zizyphus attracting nectar foragers only.

The six plants with the highest mean number of bees recorded per observation period were Brassica (48.9), Litchi (43.5), Citrus (29.3), Bombax (19.8), Moringa (12.8) and Syzygium (10.3). Cocos (5.2), Musa (3.3) and Amaranthus (2.6) flowered almost continuously but attracted comparatively few bees per observation period.

5. Numbers of foragers returning to their hives with nectar and pollen loads

Counts of the returning foragers were made regularly at 2-weekly intervals, once the colonies were established at the five sites.

Figure 1 shows the results for one of the sites (Jhitka). General activity at the hive entrance was greatest from mid October until early April. The period of least activity from mid April to early October coincided exactly with the dearth period identified from the bee forage calendar (Table 8). The peak in the numbers of foragers returning to the hive in early January occurred at the same time as Brassica and Moringa were attracting large numbers of foragers (Table 8). The smaller peak in activity to be seen in Figure 1 occurred at the same time as Zizyphus, Mikania and Brassica were flowering. Cocos and Musa undoubtedly contributed to the flow of nectar and pollen during these peak periods, but as they were flowering all year they were unlikely to have caused the sharp rise in numbers of returning foragers shown in Figure 1.

6. Analysis of pollen grains present in the honey samples from Bangladesh

Honey samples from Bangladesh were examined at University College, Cardiff, and a list of the pollens identified is given in Appendix 9. Pollen grains of those plants marked with an asterisk have been photographed, and all pollen grains are fully described.
Of the twelve Group 5 plants only two, Justicia and Litchi, were not represented in the honey samples, and are absent from Appendix 9. These two plant species appear to attract nectar foragers rather than pollen foragers (Table 14).

7. Group 5 plants; comparison of relevant information from published and unpublished data on bee forage in neighbouring countries.

Since 1979, the International Bee Research Association has been compiling a data bank on the world's honey plants. Information on 2569 plant species was recorded and from these 467 of the world's most important nectar sources were selected for more detailed study. The Directory of important world honey sources* was published by IBRA in 1984, and gives brief botanical and full apicultural details of these 467 plants. Table 6 shows that all of the Group 5 plants are entered in the above data bank and that 10 out of the 12 plants are already known to be important world honey sources. A further 11 of the less common plants in the Dhaka area listed in Table 6 are also described in the Directory, and it is possible that these might provide important additional nectar if they were more widely grown. From Appendix 4 it can be seen that four such plants, Lippia nodiflora, Mimusops elengi, Sesamum indicum and Tamarindus indica flower during the dearth period in the Dhaka area. However, data concerning these species have yet to be analysed.

Many of the bee forage plants are already known to be multipurpose species, valued by the local people for food/fodder/firewood etc. By recommending increased cultivation of such species, it is hoped to overcome any initial reluctance which might occur if recommendations were made to plant solely for bee forage.


Conclusions

All Group 5 plants with the possible exception of Amaranthus provide A. cerana with valuable supplies of nectar and or pollen, and are already known at IBRA as major honey sources elsewhere in Asia.

Most Group 5 plants flower between mid October and early April, and it is during this period that the major honey flows occur. Brassica attracts the most foragers for both nectar and pollen, and its flowering coincides with the period of maximum activity at the hive entrance. Litchi is the next most attractive nectar source, although this provides little or no pollen. Bombax, Cocos and Citrus are, together with Brassica, the major pollen sources. Eleven of the 12 most abundant plant species were visited for pollen, the exception being Zizyphus.

Cocos (major pollen source, minor nectar source) and Musa (nectar source only) flower throughout the year and must be especially valuable during the dearth period.

The pollens of 10 of the Group 5 plants are present in honey samples from Bangladesh. Those of Justicia and Litchi are absent. However, these species are rarely visited for pollen.

The results obtained for the remaining 69 bee forage plants (Groups 1-4) visited by A. cerana will be similarly analysed and the results presented in the final report. Together with the data from the plant
profiles and hive data sheets, it should be possible to identify all
the major nectar sources in the Dhaka area. It is also hoped to
identify some of the less abundant species and also those which
flower during the dearth period, and to recommend their propagation
in the area.