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SECOND AMERICAN BEE JOURNEY

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I. EAST OF THE ROCKIES

I made my first American bee journey in 1953 ; I then visited New England and other Eastern States, and travelled about a thousand miles towards the Middle West — stopping short at the Mississippi — and I also went to Ontario in Canada (Crane, 1954). It was during that visit, in a discussion with Mr. R. B. Willson of New York, that the first plans were laid for a second journey, to extend my knowledge of American beekeeping to regions of the South and West, and also to see something



FIG 1. Map to show route. Scale about 850 miles per inch [540 km. per cm.]. Areas above 3000 ft. [900m.] are black.

of subtropical Central America, of which Mr. Willson spoke in such glowing terms. Through the kindness of a large number of beekeepers, bee scientists and Beekeepers' Associations, this second visit became possible 3½ years later. Thanks to their hospitality, and to the invitations to lecture which I received from Universities and Agricultural Colleges, the costs of my second journey were adequately covered.

On this journey I was able to learn something of the beekeeping and bee research in sixteen States of the U.S.A. I had not visited before, and also in Cuba, Mexico and British Columbia (Canada); the map in Fig. 1 shows my route. I travelled altogether some 6000 miles by car as well as 15 000 miles by plane; I ranged from the Tropics to a few miles short of the Arctic Circle, and from 200 feet below sea level — in Imperial Valley in California — to 15 000 feet (about as high as the highest point in Europe) on the volcanic ash which covers the slopes of Popocatepétl in Mexico.

In every new place I came to, I was met and befriended by those whose work was also concerned with bees, and the number of new friends I made is to me one of the happiest results of my travels. In order to complete the journey in the time available, however, I had to resist the very strong temptation to revisit places and friends I had seen in 1953, and this was a hard decision to make and to adhere to.

I shall report on my experiences and impressions in three articles: I. States east of the Rockies (Pennsylvania, Maryland, Washington, D.C., North Carolina, Wyoming, Colorado, Minnesota, Iowa); II. States of the South and West (Florida, Louisiana, Texas, Arizona, California, Oregon, Washington, British Columbia, Utah); III. Cuba and Mexico.

PENNSYLVANIA

I left London on March 9th, and flew via Iceland (still covered with snow and ice), over Greenland and Labrador to New York, and thence to Allentown. Here I met Dr. F. B. Wells, and was able to thank him personally for the many abstracts he has sent for *Bee World*. I enjoyed my brief stay with Dr. and Mrs. Wells immensely, and was able to meet a number of Pennsylvania beekeepers at their house. I wished there was more time to discuss with Dr. Wells various problems connected with abstracting, but I had to leave next morning for Philadelphia. I was going there for three reasons: to meet Dr. J. W. White and hear of the work he is doing on honey, to see the Morris Arboretum and to give two lectures there, and to see where Langstroth was born and lived. Dr. White, working at the Bureau of Agricultural and Industrial Chemistry of the U.S. Department of Agriculture, has for some years been investigating the sugars in honey, using various improved techniques [A.A. 36,111/54; 58,306,307/55; White (1957)]. He is at present making a large-scale survey of U.S. honeys, using his new selective adsorption method to determine the sugars, and other methods for nitrogen, ash, acids and enzymes. The sugar fractions are examined qualitatively by paper chromatography; five disaccharides have been identified and several others await identification. Dr. White also showed me *dried* honey — in flakes looking rather like very thin flakes of shellac. There are various possibilities for using this dried honey commercially; however it absorbs water rapidly if exposed to the air, and the container can therefore only be opened in a dry-room. This difficulty can be overcome in commercial use, however, by marketing packages of such a size that all the contents would be used at once.

The Morris Arboretum — in the charge of Dr. J. Fogg with whom I stayed — contains the Langstroth Memorial Garden which was dedicated in 1951, the centenary of Langstroth's discovery of the bee space. Dr. Fogg and Mr. F. W. Schwoebel took me to see it, and the

memorial seat which bears the inscription ' Lorenzo Lorraine Langstroth — 1810-1895 — father of modern beekeeping ', together with an account of the discovery and importance of the bee space, ending with the words : ' It is fitting, therefore, that this bee garden of trees and shrubs be gratefully dedicated to his memory in the community where he was born and reared ; and in which a century ago he made the basic discoveries which revolutionized beekeeping throughout the civilized world ' (Morris Arboretum, 1952).

The next day Mr. Schwoebel took me round Philadelphia on a Langstroth pilgrimage, and I could not have had a guide who knew more about his subject. Langstroth was born in Philadelphia, and also lived there from 1848 to 1852. The site of his birthplace (106 South Front Street, near the Delaware River) is now occupied by a warehouse, and the house in Chestnut Street where he was living in 1851 when he discovered the bee space, is now a drug store. It was in the square by Independence Hall, where the Declaration of Independence had been signed in 1776, that he found his specimens of cicadas when he was a boy. He wrote later ' I was not over twelve years of age when I made most of my observations upon these locusts ; but when I returned to Philadelphia in the fortieth year of my age, it being locust year, I collected quite a number of larvae from the trees in Independence Square, and sat up with my daughter and some of her school companions until after midnight to show them the curious changes ' (Langstroth, 1892). I was also able to see the large collection of Langstroth papers in the Library of the American Philosophical Society, including his original Patent (1852).

On March 18th Mr. Schwoebel and Mr. P. Cummins, one of the local Bee Inspectors, took me south by car to Washington, and on the way I was able to learn something about the beekeeping conditions and problems in Pennsylvania. We also stopped to see the Dupont Gardens at Longwood ; it was still winter there, but in the glass-houses was the most breath-taking spectacle of flowers I remember having seen anywhere ; they were arranged like indoor gardens, with acacias (mimosas), lilies, cyclamens, begonias, azaleas and orchids, all bedded out to give an uninterrupted blaze of colour.

MARYLAND AND WASHINGTON

At the University of Maryland, some twenty miles north of Washington, Professor George Abrams welcomed us. All the University buildings (it has 9000 students) are in the attractive traditional style of dark red brick with white collonades and windows, and on a hilltop in the centre of the campus is a white-spired chapel. Mr. Abrams, who is Professor of Apiculture, has a building of his own, well equipped in every way, with apiaries round it.

At the International Beekeeping Congress in Vienna last year, Mr. J. I. Hambleton, the United States delegate, invited the XVIII Congress to the United States for 1960 ; he had in mind, as the meeting place for the Congress, this University — which could provide not only lecture rooms and offices but also accommodation for Congress members. Both Mr. Hambleton and Professor Abrams asked me what the chances were that the invitation would be accepted. I could not give them an answer, but I can assure beekeepers that they would find a warm welcome in Maryland, and that everything possible would be done to overcome

the difficulties of the long and expensive journey for members living outside America.

I gave three lectures in the University of Maryland : one, sponsored by Sigma Xi, to University staff and graduates, among whom I met my old friends Mr. H. J. Clay and Mr. R. E. Snodgrass ; one to zoology students, including a number of Chinese ; and one to the Maryland State Beekeepers' Association. The last was followed by refreshments in the Apiculture building ; it was too early in the year for beekeeping demonstrations. I slept that night at the Faculty Club of the University, in the room reputedly used by Lafayette on his way to visit George Washington in 1784, when the house was a coaching inn.

The headquarters of the U.S.D.A. Bee Division, now the Field Crops Insects and Bee Culture Research Branch of the Entomology Research Division of the U.S.D.A., are at Beltsville in Maryland, a few miles from the University. On the whole of my journey, this was the only place I visited which I had also been to in 1953. I was quickly encircled by friends, and it seemed impossible that I had been away for nearly four years. Mr. Hambleton, the Head of the Branch, brought me up to date with developments in his various laboratories, and I talked with Mr. Nolan, Mr. Abramovitz and Mr. Straughan — now the official translator for the Branch. Dr. A. S. Michael showed me the brine shrimps (*Artemia salina*) they are using for insecticide tests [*A.A.* 194/56], and their new method for feeding larvae with thousandths of a millilitre of cultures [*A.A.* 338/57].

I should like to take this opportunity of thanking the secretaries and typists, at Beltsville and so many other places, who helped me on my way by taking down my letters in shorthand, and reproducing them typed in good American.

In Washington Mr. Hambleton took me to the National Museum to see Dr. H. Friedmann, who has been investigating the honey guides [*A.A.* 83/55, 181/56], African birds which have the ability — shared by wax moths — of digesting beeswax. He and his collaborators have now found that it is a micrococcus in the intestine which enables them to do so [*A.A.* 217/57], and by culturing the micrococcus and giving it to chicks, they have been able to transfer this ability to the chicks. A tuberculosis team is now using this micrococcus experimentally (the tuberculosis bacillus is protected by a waxy layer). Dr. Friedmann brought out some stuffed birds for me to see — pretty little birds weighing about two ounces. His great difficulty is obtaining live honey guides in America for his experiments. In the Museum I also met Padre J. Mouré from Brazil, who was working there for a period on the systematics of bees [*A.A.* 2/52, 17/54].

NORTH CAROLINA

I flew from Washington to Raleigh on March 17th ; it was about 300 miles further south, and spring was already there. In the Maryland woods we had found bees foraging only on alder catkins and skunk cabbage, but here it was like an English April, with the daffodils full out. Here, as everywhere on my journey, there was the excitement of seeing for the first time the plant and animal life of another continent. In Maryland I had heard the dawn chorus of mocking birds and grackles ; here I saw the avenues of red maple (*Acer rubrum*) in flower, and the

Judas trees (red bud, *Cercis canadensis*) and peach orchards — with bees hard at work on all of them.

At the North Carolina State College of Agriculture I gave another Sigma Xi lecture, and attended an all-day meeting of the North Carolina State Beekeepers' Association. The meeting was organized by Mr. W. A. Stephen, who is responsible for the beekeeping instruction at North Carolina State College, and is also State Extension Beekeeper and President of the Southern States Beekeepers' Federation; the beekeepers of North Carolina owe much to the enormous amount of work which he and Mrs. Stephen do on their behalf.

At the meeting the talk was of gallberry (*Ilex glabra*) and sourwood (*Oxydendrum arboreum*), which are the main honey sources near the coast and in the Great Smoky Mountains respectively. Sourwood gives a particularly delicious honey, which fetches a high price. When the time came for 'presentations and awards', to my surprise and pleasure I was made a life member of the State Association, and presented with a platter made from Carolina pine and decorated with sourwood blossoms and bees. I heard Dr. Kincheloe, a Baptist minister of 85, lecture on 'Bees can step up your income'; he told the story of seventy or more years of beekeeping, and how he continually increased his colonies in order to provide his four sons with large enough apiaries to give them a livelihood, by the time they were old enough to go to college. Three of the four worked their way through college with the bees thus provided for them; the youngest developed such an ability to *sell* the honey, even before he was due to enter the University, that a college education seemed superfluous for him, and he became a salesman instead.

At the College I also visited Dr. T. B. Mitchell, an authority on the native bees of North America, and was shown specimens of some hundreds of species of *Osmia*, *Nomia*, *Andrena*, *Megachile* and other genera.

I had never yet seen beekeeping with box or log hives in the U.S., and as I knew it was still practised — to the despair of Mr. Stephen — in some of the more remote parts of North Carolina, I hoped that I should have a chance to see it here. A journey to the Smokies was out of the question on account of time, but we found one apiary not too far away; to my astonishment the box hives (standing upright like log hives, and some 3 or 4 feet tall) were freshly painted in white and looked very trim and neat. The variations in the *shape* of fixed-comb hives is always a source of interest to me, and it is not always easy to understand how they developed. In Europe the geographical distinction between high (log) hives and long low (Carniolan) hives has been fairly well established, and the high North American box hive is an understandable successor to a sawn-off hollow log placed upright. But in Mexico the only fixed-comb hives I saw were similar to Carniolan hives.

I left North Carolina to fly south to Florida, which will be dealt with in Part II. I had already fallen under the spell of the Southerners, with their slow soft speech, their courtesy and open-hearted kindness. I was also beginning to realize how little I had yet seen of America and her peoples.

WYOMING AND COLORADO

I came east of the Rockies again six weeks later, crossing the Continental Divide on May 2nd. I went first to Laramie in Wyoming, where the U.S.D.A. Intermountain States Bee Culture Laboratory is housed in

the University. Laramie is 7200 feet above the sea, and is I think the highest city in the United States. It was chosen for the study of bee diseases because there is virtually no beekeeping within fifty miles of it, and diseased colonies can therefore be used without fear of infecting others in the neighbourhood; the winters are so long that no wild honeybee colonies can survive them. The high Laramie Plains are divided into large cattle ranches, and here the wild antelope run with the cattle — the fences are high enough to keep cattle in, but they cannot keep the antelope out. The Plains are surrounded by higher mountain ranges; many people told me that these ranges have some of the most beautiful mountain country in the world, but they are quite inaccessible until June or July, so I could not visit them.

Laramie (first settled in the 1860s and named after a French fur trader) has become well known in beekeeping circles for the work done there on bee diseases under the direction of Dr. A. P. Sturtevant, who is due to retire this year after some forty years' service with the U.S.D.A.; he has been in charge of the Bee Laboratory since it was founded in 1926. The other members of the staff are at present Mr. J. D. Hitchcock — who is also in charge of abstracting U.S. publications for *Bee World* — and Mr. I. L. Revell. Dr. C. E. Burnside, one of the leading research workers on bee diseases, worked at Laramie until his sudden death in 1949 [A.A. 42/53]. Much, but not all, of the research has been on foul brood [A.A. 7/50, 25/54]. I was able to see the results of fourteen years' work on breeding bees for resistance to A.F.B., in which 100% resistance was finally attained in some strains [A.A. 5/50]. This resistance is probably due to the behaviour of the adult bees in cleaning the cells, but other experiments at Laramie have shown a different type of resistance, due to the removal of A.F.B. spores by the proventricular valve [A.A. 47/55; see also page 235].

In recent experiments, radioactive tracers and other methods of marking bees have been used to study the transmission of foul brood by robbing and drifting. The Bee Laboratory has just moved into a new building, designed with much care by Dr. Sturtevant and his colleagues, and excellent in every way.

I left Laramie on May 5th, driving with Mr. Hitchcock and his family through the mist-covered mountains 'down' to Colorado, where we were only 5000 feet above the sea. (Denver, the State capital, is the 'mile-high city'.) Here we were in early spring, with the dandelion flow at its peak. I stayed at Fort Collins as a guest of Professor J. O. Moffett and Mr. W. T. Wilson, the entomologists responsible for the beekeeping teaching and research at Colorado State College — which has just become the State University. There have been serious outbreaks of E.F.B. in Colorado in the past few years [A.A. 175/52], and Mr. Moffett has investigated the effect of various antibiotics on diseased colonies [A.A. 142, 235, 236/54, 128/55]. Mr. Wilson is engaged on a study of Colorado honey plants and their nectar, in addition to E.F.B. work.

I watched the beekeeping class — which included Professor M. H. Khan, an agronomist from Pakistan — learn to instal package bees, and I learned with them. I had seen packages prepared, and start off on their 1000 or 2000 mile journey, in Texas and again in California. Here I saw the packages arrive — in excellent condition — each in a box with two sides of gauze for ventilation, with a tin of syrup and with a caged mated

queen. Since each student was to start a colony as a beginner would, the bees were not hived on to drawn-out comb with stores of pollen and honey, but on to foundation. They were sprayed liberally with syrup, then (the queen cage having been carefully removed) shaken into the brood box from which four frames had temporarily been taken out, and — after bees and queen had been sprinkled again with syrup — the queen was released directly on to the mass of bees before the four frames were put back into the hive.

My hosts showed me much more of the country and life of Colorado than the beekeeping, and I enjoyed myself immensely. I saw the Rocky Mountain National Park — most of it still under snow — and the beaver dams and lodges there. I visited Central City ; this is almost a ghost town now, but gold mining and panning once made it the ' richest square mile in the world ' ; a number of the gold mines are being reopened now as uranium mines. I went round the Bull Farm of the University (which has a very strong Veterinary School), and I also saw the striking modern ' dormitories ' of the University, which make any student accommodation in this country seem old-fashioned. Finally, I attended the Inter-University Rodeo, and watched enthralled as the students competed at bronc riding, calf roping, steer wrestling, bull riding and — a final crescendo of excitement — the wild cow race.

I left this ' mile-high ' country on the evening of May 7th, after looking out from a red sandstone outcrop of the Rockies, eastward over Denver to the Kansas plains beyond, which drop gradually down to the Mississippi nearly a thousand miles away to the east. Behind, to the west, a thousand miles of mountains lay between me and the Pacific coast from which I had come.

MINNESOTA

The same evening I flew north-east as far as the Mississippi, to the twin cities of Minneapolis and St. Paul, the home of the University of Minnesota, with 25 000 students and 7000 academic and other staff. It was very late when I arrived, but Professor Haydak was there to meet me, smiling as always ; we had last seen each other in Illinois in 1953. I had come to Minnesota to give three lectures at the Beekeepers' Short Course — what we should call in England a week-end school. I also learned much that was new to me, both at the lectures I attended and in conversation at mealtimes. Professor Haydak lectured on pollen substitutes, queen rearing and pollination by bees. He has carried out many investigations on pollen substitutes [*A.A.* 15/50] ; the mixture he finds best is soya-bean flour, commercial casein, dried skimmed milk and dried egg yolk, in the proportions $1 : 1\frac{1}{2} : 1 : \frac{1}{2}$. Dr. Haydak also gave a demonstration of installing package bees [*A.A.* 26/51] in the University apiary, which is a very peaceful place, sheltered by a copse ; spring had come early to Minnesota this year, and the trees were full of young green leaves. The bees were hived on to drawn-out comb, and fed liberally throughout and after the operation. Dr. Haydak is an expert at handling bees, and the beginners in the class gained confidence right from the outset.

Dr. T. A. Gochnauer lectured on bee diseases, and over breakfast and lunch (asparagus and strawberries were the staple vegetable and fruit here) he told me about his work on bacteriophages [*A.A.* 64/57] and on A.F.B. [*A.A.* 59,191/54, 80,213/57] and E.F.B. [*A.A.* 197/54]. Mr. C. D. Floyd, the State Apiarist, and Mr. Robert Banker, Secretary of the

American Beekeeping Federation, gave me some idea of the importance and problems of beekeeping in Minnesota [A.A. 193/57] ; it is the second most important State, producing 10 000 tons of honey a year — a tenth of the total U.S. production and about twice that of Britain. Much of the honey comes from sweet clover (*Melilotus*).

Mr. B. A. Haws and Dr. Kenneth Tucker are investigating lucerne (*Medicago*) pollination in northern Minnesota. Although so much work has been done on the subject, the conditions there are such that the results obtained in other States [A.A. 72/53] do not apply. Dr. Tucker's major interest is however in sex determination in honeybees, which he has been investigating for several years at Davis, California. In his doctorate thesis he has set out a theory which accounts for all the evidence so far known, and fits in well with the experimental results obtained by Mackensen [A.A. 98/52, 287/56], Laidlaw and Rothenbuhler and others.

All too soon it was time for me to leave ; I wished I could have seen more of Minnesota and its beekeeping. But I had enjoyed my brief contact with these scientists and had found their work and ideas most stimulating.

IOWA

From Minnesota I flew south to Iowa, on the afternoon of May 9th, for another Short Course — this time at Iowa State College of Agriculture at Ames. Dr. W. C. Rothenbuhler met me at Des Moines, thirty miles away, and during the drive back he started to bring me up to date with the research being carried out there. The College has a high tradition in bee research. Dr. L. R. Watson and Dr. O. W. Park were both at Ames until they died ; Mr. F. B. Paddock is known throughout the world for his *Iowa State Apiarist's Report* — this has unfortunately now ceased publication — and the present team is maintaining and even raising the standard.

Dr. Rothenbuhler and two graduate students, V. C. Thompson from Arkansas and Dale Polhemus (brother of M. S. Polhemus who has now left the Department) are at present engaged on three problems : genetics [A.A. 70,213/52, 51/54, 35/56], gynandromorphism in honeybees [A.A. 6/51, 16/53, 309/57], and disease resistance [A.A. 214/57].

In their studies on pure genetics, they are using as markers various mutations they have managed to collect — white, ivory, snow and chartreuse eye colours, cordovan (black on the exoskeleton replaced by brown), hairlessness, and 'droopy', in which the wings are not held along the back, but droop down, so that the bees cannot fly, nor right themselves if placed on their backs [A.A. 51/54, 35/56]. Later I was able to see these mutations in the experimental apiaries — they certainly add variety to colony examination !

Gynandromorphs are also useful in studying inheritance. They are female bees, but with a little male tissue somewhere, which is formed as follows. Usually several sperm enter the egg when it is fertilized ; all but one die, and the surviving one leads to the development of a normal worker (or queen) bee. But occasionally another sperm also survives, and develops by using the cytoplasm from the egg. It can only develop into male tissue, and this it does, the resultant worker having a drone head, or half its abdomen or some other part drone-like [A.A. 6/51].

In their studies of disease resistance — for which a substantial grant is obtained from Public Health funds — they are interested in three

distinct types of resistance to A.F.B. : (1) due to ' hygiene ' (cell cleaning by adult bees) as obtained by Sturtevant [page 232 and *A.A.* 5/50] ; (2) due to ' larval protection ' (some characteristic in the nursing, probably some substance in the brood food, which prevents the larvae becoming infected) ; (3) actual larval resistance to infection [*A.A.* 214/57]. They have established the existence of (3) by using a (yellow) resistant queen inseminated from both a (yellow) resistant drone and a (black) susceptible drone ; strips of cells of her eggs were used, larvae in some strips being inoculated and the others left as controls. The percentages of yellow (resistant) and black (half-resistant) workers which reached maturity were counted. The results showed little or no difference in resistance in first or third instar larvae, but a high differentiation in second instar larvae.

I visited Professor and Mrs. Paddock that evening ; we had long wanted to meet each other, and were able to exchange news of a number of mutual acquaintances. Professor Paddock, like many others I met, was full of praise for Mr. I. G. Rankin's *Beekeepers' News*.

So that I should waste none of my short time in Ames, the whole department met at Dr. Rothenbuhler's house at 7.15 next morning for a breakfast party : we had a good two hours there and in the Entomology Department before the Short Course started at 9.30. Here I found a number of friends, including Mr. and Mrs. R. A. Grout from Hamilton, and Mr. and Mrs. J. G. Jessup from Perry, Iowa. I gave two lectures, and listened to as many others as I could. I also did a radio broadcast (usually it had been television), and it was not until the lectures were finished at 9.30 p.m. that I was able to continue seeing the research work being done in the Department.

We started out again at 7.30 next morning, so that I could see the experimental apiaries, with their mutations and gynandromorph bees, before I gave my final lecture at 10.30 : I had to leave at 11.30 for the airport. How I wished I had allowed more time for these last two visits !

CONCLUSION

From Iowa I flew more or less straight home. At 23 000 feet above the cloud-covered Atlantic I had an excellent view of the total eclipse of the moon (May 13th). The final flight from Boston to Prestwick took only $8\frac{1}{2}$ hours in a new DC7 aircraft : never had England and America seemed so close.

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Correction to p. 233 : Dr. Haydak's pollen substitute contains also 1 part dried brewer's yeast.