(7) MARIN, E.C. 1966. Honey Bee Pollination of the Highbush Blueberry. V 106 American Bee Journal. V 106 No. 10 p. 366-367.
(8) OLDERSHAW, D.H. 1966. Pollination Studies on the Tall Bush Blueberry. Report of the North American Blueberry Council Annual Meeting at Vancouver, B.C.

BEE MEETING SET

The Annual Joint Meeting of the Bucks County and Montgomery County Beekeepers' Association will be held on the Delaware Valley College campus on Saturday, June 24, 1978. The formal meeting will begin at 1:30 P.M., with a bring-your-own picnic lunch starting at noon.

The speaker for the afternoon will be Mr. Joe Gitta of Denton, Md. Mr. Gitta is a queen breeder, queen and package bee producer, pollinator, and honey producer. He will be presenting a workshop on the ancient art of making straw skeps and hives.

Following Mr. Gitta's presentation, there will be an open house at the Delaware Valley College Apiary and Honey House including refreshments.

Delaware Valley College is located on Route 202, one mile west of Doylestown, Pa. and about 12 miles south of Lambertville, N.J. The meeting is open to all beekeepers and to anyone else who is interested.

During Wednesday, Thursday, and Friday, June 28, 29, and 30th, Delaware Valley College will be holding its Annual Summer Beekeeping short course, and more information on it can be obtained by writing Dr. Robert Berthold, c/o Delaware Valley College, Doylestown, Pa. 18901 or by calling him at 215-345-1500.

Don Cooke, with bee beard, is one of the founders of Ohio's famous Honey Festival. Each year at the Festival he dons a bee beard several times to delight an audience of thousands. Here he was assisted by John Caulk, course instructor for Bee Technology at the Agricultural Technology Institute in Wooster. John is in charge of the Bee Workshops at the Eastern Apicultural Society meeting Aug. 9-12 in Wooster, Ohio. One of the Workshops will demonstrate how to make a bee beard. This time we're told John will wear the beard assisted by Don. For more information about the meeting write E.A.S. Registration, c/o Wm. McNutt, 245 North St., Columbus, OH, 43216.

EAS JOURNAL
c/o J. C. Matthenius, Jr.
516 Victory Avenue
Phillipsburg, N. J. 08865

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EAS JOURNAL

EASTERN APICULTURAL SOCIETY OF NORTH AMERICA, INC.

JUNE, 1978

EAS ANNUAL CONFERENCE - AUGUST 9-12, 1978

Tentative Program

WEDNESDAY, AUGUST 9, 1978

1:30- 4:30 p.m.	Registration - Lowry Center
5:00- 6:30 p.m.	Dinner-Cafeteria, Lowry Center
7:30 p.m.	Delegates Meeting, Faculty Lounge, Lowry Center
8:00 p.m.	Square Dance, Sing-Along, and Variety Show - Lowry Center. Master of Ceremonies: Don Cooke.
9:00 p.m.	Directors Meeting, Faculty Lounge, Lowry Center

THURSDAY, AUGUST 10, 1978

7:00- 8:00 a.m.	Breakfast - Cafeteria, Lowry Center.
8:45 a.m.	Organ - McGaw Chapel:
9:00 a.m.	Call to Order: John Root, President, E.A.S.; Vice-President A.I. Root Company. Invocation: The Reverend Paul Varner. Welcome: Richard Osborne, President Ohio Beekeepers' Association. Welcome: Dr. Roy M. Kottman, Dean, College of Agriculture and Director, The Ohio Agricultural Research and Development Center.
9:30 a.m.	"The Contribution of Bees to Crop Production and the Environment", Dr. E. C. Martin, National Program Staff, U.S.D.A., Beltsville, Md.
10:00 a.m.	Break.
10:30 a.m.	"The Honey-Bee Biological Clock", Dr. John A. Kefuss, Toulouse, France.
11:00 a.m.	Professional Apiculturists Meeting, Building 16, Room 225; OR Ladies Luncheon, Buses load at Lowry Center, Speaker: Mr. John E. Ford, Curator, Secrist Arboretum. Topic: "Secrist Arboretum--Its Treasures and Secrets, Old and New". OR Movies in McGaw Chapel: (1) "USDA Movie on African Bees" (2) "Mathematics of Honey Comb".
11:45-12:45 p.m.	Lunch - Cafeteria, Lowry Center.
1:00 p.m.	Presiding: C.A. Divelbiss, E.A.S. Vice President. Informal Slide Show - McGaw Chapel or Mraz Video Type on "Bee Venom Therapy" in Library.
1:15 p.m.	"Ohio Honey Festival", Charles A. Fisher, Vandalia, Ohio.
1:30 p.m.	"Report from Apimondia", Charles A. Divelbiss, Mansfield, Ohio.
1:55 p.m.	Leave for Root Company Tour and Workshops in Medina, Ohio. Buses leave from Lowry Center. Workshops: Organized by John Caulk. 1. "Cobana Honey Production" Mr. Barry Semagrin. 2. "Package Bee Installation" Mr. Victor Thompson.

(continued on page 3)

Renowned wildlife photographer and Audubon Society tour speaker Karl Maslowski will give one of his spellbinding film presentations at the Aug. 9-12 Eastern Apicultural Society meeting. This event will be sponsored by the Southwestern Ohio Beekeeper's Association. For registration information on the E.A.S. meeting write E.A.S. Registration, c/o Wm. McNutt, 245 North St., Columbus, Ohio, 43216.

EAS JOURNAL

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*Of which $2.00 is subscription to Journal.

Letter to the Editor

Rt. 1 Box 307A
Manchester, N.H. 03104

EASJ
c/o J.C. Matthenius, Jr.
Dept. of Agriculture
P.O. Box 1888
Trenton, N. J. 08625

Dear Sir:

Regarding an article in the December Issue (EASJ) I would like to make a comment on bee venom. For more than a year pure bee venom has been approved by the FDA and available for treatment of those sensitive to bee stings. It is now being produced by the Center Laboratories in Port Washington, N.Y.

This is something allergists have wanted for years. As a general practitioner, however, I have used the previous material made from the entire body of bees, hornets, yellow jackets and wasps and strangely enough all patients treated have been stung by my bees after a course of treatment without ill effects. Since only about 10 patients were so treated, it may be too small a number to make a final judgment. I still would prefer the pure extract which I have found also very effective in the treatment of several hundred patients with rheumatoid and degenerative arthritis, bursitis and myositis but which the FDA has prevented me from importing from Germany for use in these conditions.

The treatment of any disease is best when based on the cause and since the cause of the above conditions is now known - all treatment is on an emperical basis - trial and error. All treatments at this time are not curative - merely palliative - except in the case of bursitis and myositis on which I have had no recurrences. For reasons beyond my comprehension several patients treated for acute rheumatoid arthritis have up to 10-15 years been free of symptoms. The treatment of bursitis with pure bee venom has been so dramatic and so simple to give and at very little cost compared to other modalities.

Very sincerely,
Hermann N. Sander, M.D.

Any beekeeper getting bee kill from Penn Cap M contact:
Gary D. Curl
Warminister Research Station
900 First Avenue
King of Prussia, Pa. 19406
or call 215-265-3200

EAS ANNUAL CONFERENCE

(continued from page 1)

3. "Candle Making". Dr. Robert Berthold.
4. "Swarming". Dr. John Ambrose.
5. "Candle Making". Ms. Jody Semagrin.
6. "Disease Inspection and Identification". Mr. Gordon Rudloff.

5:30 p.m. Cash Bar - Medina Fairgrounds.
Barbeque - Medina Fairgrounds

FRIDAY, AUGUST 11, 1978

7:00- 8:00 a.m. Breakfast
8:45 a.m. Organ - McGaw Chapel:
Presiding: Richard Osborne
9:00 a.m. "The Hobbyist and Inflation", The Rev. Joe Stewart, First Baptist Church, Holyoke, Colorado.
9:30 a.m. "Bee Research in Ohio", Dr. Jovan Kulincevic, Susan Grant, Nathan Drum, et. al.
10:00 a.m. Break.
10:20 a.m. "Two Opportunities That Come to An Urban Beekeeper", Charlie Duncan, Santa Monica, California.
11:00 a.m. Business Meeting - McGaw Chapel.
11:45-12:45 p.m. Lunch.
1:15 p.m. Presiding: V. C. Thompson, EAS Director from Ohio.
Informal Slide Show - McGaw Chapel, or Mraz Video Tape on "Bee Venom Therapy" in Library.
1:30 p.m. "Wildlife by Day and by Night", Mr. Karl Maslowski, Internationally known nature photographer, Cincinnati, Ohio (sponsored by Southwestern Ohio Beekeepers Ass'n.)
3:00 p.m. Break.
3:30- 5:30 p.m. Workshops OR Movies OR Tour of OARDC Arboretum
Workshops at Agricultural Technical Institute, Private Cars, Maps provided. Organized by John Caulk.
1. "Skep Making". Mr. Joe Gitta.
2. "Making Mead". Dr. Roger A. Morse.
3. "Dipping Candles". Mr. Art Dean.
4. "Royal Jelly Production". Mr. John Caulk.
5. "Equipment Demonstration". A.T.I. Students.
6. "Living Bee Beard". Mr. Don Cooke and Mr. John Caulk.

OR Movies - In room at Agricultural Technical Institute.
1. "Baobab: Portrait of a Tree" (52 minutes).
2. "Mathematics of the Honey Comb" (12 minutes).
3. "USDA Movie on African Bees" (20 minutes).

OR Tour of OARDC Arboretum - Private Cars to OARDC, Maps provided.
6:30 p.m. Fruit Punch Special - Lowry Center.
7:00 p.m. Banquet.
Speaker: The Preachin' Deacon.

SATURDAY, AUGUST 12, 1978

7:00- 8:00 a.m. Breakfast
8:45 a.m. Organ - McGaw Chapel: Presiding: Mr. Ross Hopkins, President-Elect, EAS.
9:00 a.m. "Chalk Brood", 7th Speaker.
9:30 a.m. Hambleton Award Recipient.
10:00 a.m. Break.
10:30 a.m. 8th Speaker
11:00 a.m. 9th Speaker

(continued from page 3)

9:00-11:30 a.m.	Movie Program for Children of Any Age, Building 16, Room 1. "Beaver Valley" (32 minutes). 2. "Moose Baby" (15). 3. "Marvels of The Hive" (18). 4. "Beautiful Birds of Ohio" (30) 5. "Singing Frogs and Toads" (11). 6. "Say Goodbye" (52). 7. "Billion Dollar Marsh" (29) or similar movies.
11:45-12:45 p.m.	Lunch - Goodbye Until 1979.

Information About EAS 78 Conference

The 24th annual conference of the Eastern Apicultural Society will be held at the College of Wooster, Wooster, Ohio, August 9-12, 1978. The Ohio State Beekeepers' Association will be hosting the conference.

All registrants -- full conference, campers, commuters, one-day conferees, and walk-in registrations will be accommodated. It will be possible to purchase a single night's lodging or a few meals. This is designed to encourage participation by those who would like to come to the conference but can only attend for a day or so. Persons registering for the full conference, however, will be given reduced rates. We urge you to register for the full conference and to send in your reservation as soon as possible to facilitate the record work involved and to avoid a late registration fee.

Additional services for physically impaired persons will be available.

Parents -- bring your children. Special movie programs for children are planned. Recreation opportunities on campus include golf (18 hole course), bowling, billards, tennis, and swimming. There will be a charge for some activities.

MEMBERSHIP: The Eastern Apicultural Society of North America does not require individual membership for eligibility to attend its conference. Membership is automatically granted to each person attending the full conference. If you have already paid your dues for 1977-78, this amount is to be deducted from your conference payment. Life membership confers an automatic $3.00 deduction from the conference cost. Membership includes a subscription to the EAS Journal.

ACCOMMODATIONS: Our registration and headquarters building will be the air-conditioned Lowry Center. It contains the cafeteria, banquet room, lounging area, and rooms for EAS and commercial exhibits. The general meeting room will be in McGaw Chapel, about two short blocks from Lowry Center, with a seating capacity of 1500 persons. The seats in McGaw Chapel are comfortable but they are not cushioned. Bringing a cushion with you might be in order. Other activities will be in surrounding classroom buildings.

Lodging will be double-occupancy in near-by residence halls, with men's and women's bathrooms on each floor. A few single and triple rooms are available. Small children will be accommodated in their parents' room, but you will have to provide their bedding materials. Stairways serve the floors above ground level. Each person will have a linen packet -- sheets, pillow case, pillow, hand and bath towel, wash cloth, blanket, soap, and drinking cup. Beds are not "made up". Dorm rooms are not air conditioned.

Meals will be cafeteria style in Lowry Center, except for the barbecue (at Medina), the ladies luncheon (at nearby Ramada Inn), and the banquet. Tickets for individual meals, the barbecue, the ladies luncheon, and the banquet may be purchased at the EAS registration desk.

Ladies: The banquet room of the Ramada Inn can accommodate only 225 persons. Send in your reservation early and indicate on the registration form if you desire to attend the ladies luncheon. Reservations will be accepted -- up to 225 -- on a "first come" basis. Luncheon tickets included in the full-conference price.

Free parking will be adjacent to Lowry Center and some of the residence halls.

All dormitories and meeting rooms are within two blocks of Lowry center.

The workshops will be at Medina (A.I. Root Co. on Thursday afternoon) and at the Agricultural Technical Institute, three miles from Lowry Center, on Friday afternoon. Maps will be provided so that you may drive your own car. Free parking is available.

FULL CONFERENCE FEES per person in a dormitory room: Registration $15.00, meals $36.50. Lodging -- single $28.50, double $47.00. Total costs will be: Single person $80.00 and for two persons occupying a double room $150.00

If you have pre-registered, a packet containing meal tickets, name badge, program, and other material needed will be waiting for you at the EAS registration desk at Lowry Center.

CAMPERS: Two commercial camp grounds are within 20 minutes (8-15 miles) of Lowry Center. They are: Whispering Hills, Township Road 211, Shreve, Ohio (Phone: 216 496-2685) and Lake Wapasun, State Route 514, Shreve, Ohio (Phone: 216 567-2137). Make your own contacts and arrangements.

Self-contained units may park on the campus during the day, but a city ordinance prohibits their parking overnight. This is not rigidly enforced.

Wooster motels, addresses, and rates are listed below:

Wooster Inn (on campus) - a room with 2 twin beds: $18.00-$19.00.

Ramada Inn (Downtown Wooster) Phone 800-228-2828 US, 800 261-3232 Canada. Single: $22.75, Double: $26.50. Children 18 and under, no charge when in same room with parents.

L & K Motel (U.S. Routes 30 & 250) Phone: 200-447-4470, Local No. 216 264-9222. Single: $17.00-$18.00, Double: $21.00-$24.00. Children 18 and under, free when in same room as parents. (Motel rates higher in August).

Points of interest around Wooster include: Agricultural Technical Institute, Ohio Agricultural Research and Development Center with Secrest Arboretum, Kingwood Center (floricultural displays) at Mansfield (no charge), the Ohio State University Bee Laboratory at Columbus.

Summer Beekeeping Short Course Scheduled at Delaware Valley College

Delaware Valley College, Doylestown, Pa. will be offering a three-day beekeeping short course this summer. The course will be held beginning on Wednesday, June 28th, and continuing through Friday, June 30th, 1978. Hours will be 9:00 A.M. to 4:00 P.M. each day.

Over 100 people attended the Spring short course this year, which gives some indication of the popularity of the course. The program is designed to benefit the experienced beekeeper as well as providing enough information and experience to enable someone to get started in beekeeping.

The course, under the direction of Dr. Robert Berthold (Associate Professor of Biology), in cooperation with Mr. Jack Matthenius (New Jersey Supervisor of Bee Culture).

Some of the topics to be covered are: Honey Bee Ecology, Starting with Bees, Beekeeping Equipment, Colony Management, Swarm and Package Establishment, Queen Rearing, Bee Diseases, and Honey Processing and Sales. Most topics covered in discussion will also be observed and/or practiced at the College Apiary and Honey House.

Total cost for the three days of instruction is $18.00 (this does not include meals or lodging).

An application for this course or further information may be obtained by writing Dr. Robert Berthold, c/o Delaware Valley College, Doylestown, Pa. 18901, or calling him at area code 215-345-1500.

This "Beester" bonnet is a bit "far out" but one of the events at the Eastern Apicultural Society's Aug. 9-12 meeting in Wooster, Ohio, will be a Honeybee Fashion Show and Contest to choose the best apparel made with a bee or honeycomb motif. For E.A.S. registration ifnormation write E.A.S. Registration, c/o Wm. McNutt, 245 North St., Columbus, OH, 43216.

NEW EAS TREASURER

At the April 8, 1978 Board of Directors meeting held at Wooster, Ohio, Mrs. Liz Rodrigues was elected by the EAS Board to serve as both EAS Secretary and Treasurer.

Future E.A.S. Conferences

Wooster, Ohio - 1978
Carliton College, Ottawa, Canada - 1979
Univ. of Vermont - 1980
Rutgers Univ., New Jersey - 1981 (if approved)

RESOLUTIONS

Proposed Resolutions should be mailed in advance if possible to George Rigby, EAS Resolutions Chairman, Cedarcrest Ave., Salem, Mass. 01970, or handed to him, or a member of the Committee as early as possible at the Conference, Aug. 9 so they may be considered before Friday, Aug. 11.

THE SEASONAL CYCLE OF SWARMING IN HONEYBEES

Richard D. Fell, John T. Ambrose, D. Michael Burgett,
David DeJong, Roger A. Morse and Thomas D. Seeley

SUMMARY

A six-year study of natural swarming in Ithaca, NY, USA, showed a bimodal distribution for date of swarm emergence, with a peak during the first two weeks in June and a lesser peak during the last week in August and the first week in September. The mean swarm size for 126 swarms was 1.53 kg (11,800 bees). The mean weight of 116 swarm queens was 195.9 mg; of mated queens 203.4 mg, and of virgin queens 185.0 mg. Data from 1976 suggest that a virgin or a young mated queen may accompany a prime swarm.

INTRODUCTION

The time of year when natural swarming occurs in honeybees (Apis mellifera) is of wide interest to beekeepers, since successful swarming by a colony often results in an economic loss to the beekeeper. Information on management practices which can reduce the occurrence of swarming is available (Demuth, 1921), but their successful application requires a knowledge of the yearly reproductive cycle. Burgett and Morse (1974) examined the time of natural swarming in honeybee colonies over a three-year period in the central New York (Ithaca) area (latitude 42 degrees 27' N). The frost-free dates for the area are approximately 15 May - 15 September. Ambrose (1975) provided additional information on the time of swarming in the same area. This paper considers these original data, and extends them to a period of six years.

METHODS AND MATERIALS

The techniques utilized for data collection were basically the same as those described by Burgett and Morse (1974). Swarms reported by telephone (86% of those from which data were obtained) were collected, when accessible, in a five-frame nucleus box, and returned to the laboratory for weighing. Swarms were also obtained from colonies in our own apiaries that were allowed to crowd naturally (14%); most were in two Langstroth hive bodies (84 litres), but one-third were in a single body (42 litres). These swarms were treated in the same manner. The weight of each swarm was determined to the nearest 10 g. the number of bees in the swarm was calculated on the basis of 7700 bees/kg, 3500 bees/lb (Mitchell, 1970).

Queens were weighed to the nearest 0.1 mg on a Metler H51 balance, within 24 hours of swarm collection. The reproductive condition of each queen was determined by observing subsequent egg-laying behaviour, or by dissection. Queens that gained weight and began laying eggs within 2 or 3 days were assumed to be mated. Queens whose reproductive condition was not determined have been indicated separately in Fig. 1C.

RESULTS AND DISCUSSION

Swarm emergency dates are plotted (Fig. 1A) for the 235 swarms collected during 1971-1976; 191 of them (81.3%) were between 5 may and 21 July, and 43 (18.3%) between 14 August and 19 September. One swarm (0.4%) was collected during the intermediate period. There were peak swarming periods during the first two weeks in June and during the last week in August and the first week in Spetember. As first noted by Burgett and Morse (1974), a well defined non-swarming period existed between mid-July and mid-August. The one swarm collected during this period was from a feral colony.

The population of bees in the swarms varied from just over 2400 bees (310 g) to over 41,000 bees (5.33 kg). The mean population was 11,800 bees (1.53 kg); see Fig. 1B, which does not include the largest swarm.

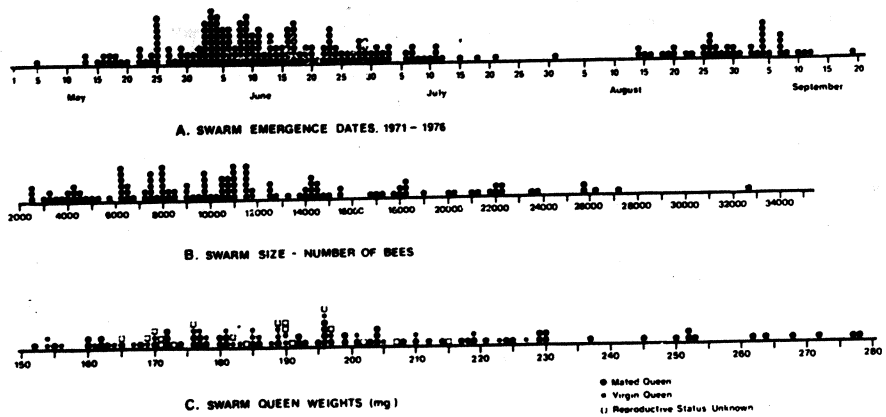

FIG. 1. Frequency distributions for the swarms studied
A Date of emergence, all years 1971-1976, 235 swarms
B Size (number of bees calculated at 7700 per kg), 126 swarms
C Weight of queen(s) in mg, total no. 116

The mean weight of 116 swarm queens was 195.9 mg. Foc mated queens (68) the mean was 203.4 mg. and the range 152.0 to 277.6 mg; for virgin queens (30) the mean was 185.0 mg and the range 154.1 to 226.5 mg. Most swarms contained only one queen, but 3 contained two queens, all six being virgins. The three swarms with two virgin queens were larger than average, the number of bees in them being 18,200 (2.35 kg), 12,200 (1.59 kg) and 15,500 (2.02 kg) respectively. Two swarms were found in whcih the queen carried a mating sign (remnants of male genitalia protruding from the end of the abdomen). This suggests that mating may occur while a swarm is in transit to its interim site, or that a virgin queen may leave a clustered swarm to mate.

During the summer of 1976 most of the swarm queens were dissected to determine their reproductive condition. Of 20 queens examined between 13 May and 28 June, 6 were virgins and 5 appeared to be recently mated. The percentage of virgins (26.4%) was approximately the same as in the overall study (30%).

A number of queens appeared to be recently mated. The weight of these queens was low (mean 168.0 mg), and their ovaries were underdeveloped (Table 1, although all the spermathecae contained active spermatozoa. It was the ovary condition that suggested recent mating, since no 'near' terminal oocytes were found in any of the queens, and only very small developing eggs in two of the queens with larger ovaries (no. 1,5). The ovaries were also considerably smaller than for any mated swarm queens which are known to have laid before swarming. One of us (R.D.F.) has found ovaries no smaller than 20.9 mg (wet weight) in previously laying queens (n equals 8) caged in a swarm for an extended period of time. The ovaries of the 'recently mated' queens were only slightly heavier (wet weight) than those of the 6 virgin swarm queens (mean 3.09 mg). The average ovary weight for the 9 other mated queens collected during the same period was 42.32 mg.

TABLE 1. Weight and condition of recently mated swarm queens.

Queen no.	*Queen wt (mg)*	*Ovary wet wt (mg)*	*Ovary condition*
1	152·0	14·10	some developing eggs
2	164·9	11·67	no eggs visible
3	188·6	6·52	no eggs visible
4	172·3	6·70	no eggs visible
5	162·0	13·34	some developing eggs
Mean	168·0	10·47*	

*The average weight of ovaries of mated, previously laying swarm queens was 42·32 mg; all contained developed eggs.

It is believed that at least 6 of the 11 swarms headed by a young queen were primary swarms. This is based to a large extent on swarm weights; it was not possible to classify accurately of all the swarms. In 1974-76, the three years for which the most accurage records are available, the weight of 66 swarms with mated queens averaged 1.54 kg, and of 26 swarms with virgin queens (prime and after swarms) 1.14 kg. In 1976 the weight of swarms with mated queens averaged 1.54 kg, of swarms with newly mated queens 1.44 kg, and of swarms with virgin queens 1.23 kg. Six of the swarms with young queens (newly mated or virgin) were believed to be prime swarms; their weights were 1.50, 2.33, 1.62, 1.11, 2.04, 1.39 kg. Observations made at the end of the 1976 summer and in late spring of 1977 showed that a strong colony can cast a prime swarm with a virgin queen. Such swarms weighed 1.25, 1.36 and 1.59 kg. In 1977 we obtained a prime swarm weighing about 2.7 kg, with several virgins; twice the swarm had left with the original queen (marked), and returned, before the issue of the swarm with virgin queens.

The larger proportion of prime swarms with young queens in 1976 (6 of 15) is thought to be a result of the poor weather during the 26-day period at the end of May and the first half of June. The maximum daily temperature was below 21 degrees centegrade on 12 days, and it either rained or was overcast on 4 of the other 14 days.

Colonies that are ready to swarm may be prevented from doing so by poor weather, and virgin queens that are ready to emerge may be held captive in the cells by workers (Huber, 1792). A crowded colony under study at our laboratory was observed to contain a mated queen (marked) and a virgin queen held captive in her cell; swarming was delayed because of bad weather. The colony eventually swarmed with the mated queen. If a virgin queen escapes, however, she may kill the old queen, and any swarm which emerges afterwards would consequently be headed by a young queen. Our data suggest that a primary swarm may emerge with a virgin queen, or with a newly mated queen after her return from a mating flight but before she is capable of laying eggs.

BLUEBERRY POLLINATION IN NEW JERSEY

P.E. Marucci and H. J. Moulter
Cranberry & Blueberry Res. Lab.
New Lisbon, New Jersey

In the first International Symposium on Blueberry Culture held in the Netherlands in 1967, Wood et. al (1) and Marucci (2) published papers on blueberry pollination. Reference to these and to Shutak and Marucci (3) will give the fundamentals of blueberry pollination. This paper elaborates on the relationship of bee behavior to blueberry pollination and presents previously unreported observations.

The decline of wild bee populations in New Jersey has resulted from greater use of more potent insecticides and the intensive clearing and cultivation of land which has eliminated nesting sites. As contrasted to the blueberry region of Canada, Wood et. al (1), wild bees constitute only a small percentage of the bees which forage in blueberry fields in this state. In most years, the wild pollinators are found in appreciable numbers only in a few isolated areas. Blueberry growers are now almost entirely dependent on the honey bee for pollination.

With the decline of the wild bee population, there has been a corresponding decline in production of some varieties. This has resulted from the peculiar trait of honey bees of selecting out certain varieties while shunning the others, Marucci (4). Some of the old standards cultivars not attractive to honey bees like Stanley, Dixi, Pioneer, Concord, and 1316-A have been virtually eliminated as commercial varieties. Berkeley, Coville, Earliblue, and Jersey are also gradually being phased out.

The fundamental reason for the varietal preference for certain varieties has not been precisely determined. It is not related with sugar concentration of the nectar, Marucci (2). Although good data is not available, observations indicate that the more productive and attractive varieties produce a greater volume of nectar. The honey bees seem to have a "built in computer" which enables them to select the varieties which yield a greater volume of nectar per unit time of work.

The bumble bees and other wild bees are more primitive and have less organization of colony than the honey bee. It was considered that these bees worked blueberries at random with little selection by variety. Recent observations, however, show that the bumble bees also exhibit preferences. They actually seem to prefer the varieties which the honey bee eschews. It is interesting to note that the varieties favored by the bumble bees are, to the human olfactory sense, more aromatic than those intensely worked by the honey bees. This appears to be an interesting avenue of research. No data has been taken qualitatively or quantitatively on the essences in blueberry blossoms. An indication that the flower petal itself is attractive, even to honey bees, is the fact that we have often seem them thrusting their heads in freshly fallen corolla on the ground.

In general, the honey bee's preference for certain cultivars varies little from one year to another. In some years, the unattractive types do get enough attention from honey bees to produce good crops. In essence, the success of the crop depends on how close to the field the bees work. In 1970 (discussed later), not even the fairly attractive Weymouth received enough bee visitations to set a good crop, but it produced well in three of four years. Of the unattractive types, Earliblue and Berkeley had good yields in only one year and Walcott in two years. Inexplicably, in 1974, honey bees conducted happy concerts in Berkeley bushes, it's blossoms receiving twice as many visits as the Weymouths and about ten times as many as the Walcotts and Earliblues. The phenominal production of 1600 flats per acre in the Berkeleys was followed in 1975 by a "silent spring" in these bushes and a poor crop. Such fluctuations in a cultivar's attractiveness to honey bees are little understood.

The behavior of honey bees around flowers varies considerably with the variety. They obviously conduct a search for blossoms to their liking. In the more attractive varieties, they alight and thrust their heads into the corolla rather promptly but do much hovering over blossoms of the problem varieties. Stop watch observations were made of the hovering time between visitations of individual honey bees in different varieties. Although a limited number of the insects (16 per variety) could be observed under identical weather conditions, the data obtained show confirmation of observations. The hovering time in the Rubel, a very attractive type, was only 4.5 seconds per visitation compared to 13.5 for Berkeley, 14.8 for Coville, and 21.4 for Jerseys. The time spent per visitation did not vary as greatly; 5.3 seconds for Rubel, 8.6 for Jersey, 9.6 for coville. These data have puzzling aspects. None of the bees observed were pollen gatherers. In the attractive Rubel variety, why was the selection time of a blossom more rapid if it did not contain more nectar? The shorter time spent in the Rubel flowers would suggest there was actually less of it than in the non-attractive types. The more constant visitation of Rubel flowers may have the effect of keeping the nectar content low. If this is true, it would invalidate our theory that volume of nectar is the basis of attractiveness. Diurnal variations in which bees fluctuate from more to less attractive ones has been observed, Marucci (5), but this does not occur often.

It is well known that the bumble bee is a more prodigious worker than the honey bee. Only a few of these marvelous creatures could be kept under close observation. A total of eleven unidentified queen bumble bees averaged 19 blossom entries per minute in the unattractive Berkeley variety. Thus, an individual did about four times as much meaningful work per unit time as the honey bee in the same variety. The bumble bees almost always stuck their heads in every open flower in the blossom cluster, often going from one cluster to an adjacent one without interruption. The honey bee rarely works more than two or three blossoms in a cluster. Another obvious advantage of bumble bees is the fact that they work longer hours under colder and windier conditions. (Although their size is menacing, stings from bumble bees have been extremely rare, while honey bee stings are not infrequently experienced).

Honey bees work flowers of all ages, but our observations indicate that there is a distinct preference for older blossoms. This is especially true in the Jerseys and Berkeleys. In these varieties, a high percentage of the bees are often observed obtaining nectar from blossoms so old that there is already a loose connection between the corolla and calyx. The bees insert their tongues at the base of the corolla and obtain nectar in this fashion. Such a feeding process is, of course, meaningless in terms of pollination. Bees with this habit go searching for loose corollas, rejecting those of younger age with tightly affixed flower petals. This habit, together with the fact that bees do not work Jerseys in high concentrations, accounts for the weakness of this variety -- the tendency to produce small seedless berries.

Jersey, once the leading variety in New Jersey, now comprises less than 10% of the acreage here. Crickenbacker's (6) blueberry acreage survey in 1970 revealed that only 11.2% of the acreage was still planted to this cultivar. Since then, more acreage has been removed and replaced with the more productive Bluecrop. Bee behavior and the parathenocarpic tendency have been key factors in the demise of this variety. In 1968, flowering laterals enclosed in cheese cloth bags, to exclude bees for nine and eleven days, each had a set of seedless berries of more than 50%, despite the fact that only 11% and 0.3% respectively still had corollas attached when bags were removed.

Even in fields where there is very good bee activity, there is often a preponderance of small seedless berries. It is our theory that the parthenocarpic tendency is encouraged by the selection of older blossoms by the honey bees.

Even when the bee thrusts its head in the corolla in the classic way, a high percentage of the flowers are probably so old that fertilization is not accomplished by the pollen transfer. The older the blossom is before pollination, the higher the percentage of seedless berries in the New Jersey Variety. This suggest that once the parthenocarpic process starts, the ovules are no longer receptive to the male gamete or they may not provide the proper chemotropic stimulus for the pollen tube.

The feeding habit of the carpenter bee (Xylocopa virginica) on blueberries has been considered to be a factor in reducing pollination. This wild bee cuts holes through the corolla to obtain nectar which other bees may use later, resulting in the lack of pollination, Martin (7), Marucci (2). Recent observations have shown that this is not a serious factor. In 1967, a field with a very dense population of carpenter bees had an estimated 53% of the Jersey flowers with the typical feeding punctures. Honey bees were seen working through these holes as well as in the normal way. The grower was well pleased with a very good crop of Jerseys of which only an estimated 19% were parthenocarpic, a relatively smal percentage for this variety.

A crop failure of early varieties in 1970 was the result of the interesting phenomenon -- the very great attraction of oak to honey bees in their time of need for pollen. During the early flowering period, the bees could not be seen foraging in blueberry fields. Weather was ideal and the nectar flow was better than average, but the bees were flying directly over blueberry fields into oak trees where they feverishly worked the catkins for pollen. For a period of about ten days, they confined their activity to the oaks, which are plentiful in the blueberry growing areas, and showed very little interest in blueberry nectar. A frame of honey from an apple orchard was placed about twenty feet away from two average hives in two separate fields, and they were completely ignored by the bees. Pollen traps inserted in hives yielded only oak pollen from May 6th to May 13th, after which only a few blueberry pollen pellets began to appear. Bee counts in Weymouths, Earliblues, Walcott, and Berkeley were almost entirely negative until May 14th when more than one-half of the corolla of Weymouth had already dropped from old age. The early varieties produced the worst crop yields in the history of blueberry culture in New Jersey. The mid-season and late varieties produced good yields as the bees returned to their normal patterns after mid May.

After consultation with beekeepers, our interpretation of the odd behaviour of honey bees is that it was a manifestation of a nutritional need and a reflection of colony weakness. Wild flowers were not abundant in the autumn of 1969, and the bees went into the winter with inadequate stores. The winter was severe, and there was high mortality. Most beekeepers fed hives copiously with sugar, but not protein, and when set out in fields, the hives were still weak. Their preference for oak was probably a response to the need of protein since the amenophilous oak flower is a much more prolific bearer of pollen. Since 1970, we have observed, every year, a little diversion of honey bees from blueberry into oak at the time catkins are at a peak. It has never again had an impact on the crop. In 1974, three hives were fed by artificial pollen as well as sugar before being set out in the field. They did not behave any differently than the three which were fed only sugar. All six concentrated on the blueberries, with a little oak pollen being returned to all six hives, when oak catkins were dehiscing.

Since the experience of 1970, the need for strong colonies has received greater recognition. An interest in importation of bees from the southern states for pollination of blueberries has been encouraged. Theoretically, bee hives from this region should be much stronger at blueberry blossom time than colonies wintered in New Jersey. Comparisons of activity in blueberry fields of hives, brought in from the southern states with that of New Jersey hives, have shown little differences. The advantage of the southern bees is probably lost in the damage to colony strength which is inherent in the rigors of transportation of more than 500 miles.

Attempts have been made by the New Jersey Department of Agriculture to standardize the strength of bee hives used for pollination. A proposed minimum standard specifies that eggs, larvae, and pupae occupy at least 800 square inches of comb, and that the hive have enough adult bees to cover eight standard frames. Pollination agreement contracts, based on this proposal, have not been used. Colony strength still varies from year to year and between beekeepers. Growers must rely on the competence and sincerity of the people in the pollinating business. Friendly relationship and mutual concern for each other's interests exist, but occasional pollination failures still can be attributed to weak hives.

The easy solution to the problem of difficult-to-

pollinate varieties would appear to be the use of much higher concentration of bees. In isolated fields, as little as two hives per acre have been enough to adequately pollinate Earliblue and Berkeley. However, as many as six hives per acre have failed to give good crops of these varieties in areas where there are many continguous fields of attractive varieties within flight range of the bees. Simple schoolboy arithmetic shows that given an easy flight distance of one mile, honey bees will forage over an area of 3.14 miles or about 2.000 acres.

The admirable work of Oldershaw (8) in British Columbia has shown that a checkerboard pattern of setting out hives singularly throughout the field gives optimum results. This has been tried in New Jersey with no benefits. The problem in this state, in contrast to British Columbia where it is often cool and windy during the flowering season, is not that the bees stay too close to the hives but that they travel too far. Since it is convenient for the beekeeper to place his hives in groups of 2 to 4, it is not objectionable. Usually equidistant ditribution of groupings are sought along the roads throughout the field. Some growers vary this by putting most of the bees as far away from neighbor's more attractive varieties as possible. No schemes of man have been designed as yet to make the bees confine their work to a given small area in open fields.

The highly organized society of the honey bee, with it's seeming intelligence, invites anthropomorphic expression. It is humbling to the growers to know that his welfare is so much dependent on these wonderful creatures. While he admires then and is very sollicitous over them, he finds two things wrong with them. They do not read the text books, and they do not care who pays their rent.

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