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FREQUENCY OF INSECT VISITORS FOR POLLEN FORAGING ON SUNFLOWER IN RELATION TO DAILY TEMPERATURE AND HUMIDITY.

By

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Summary

This paper describes the effect of temperature and humidity on the population of Apis dorsata (F.), which is the main pollinator of sunflower, at different hours of the day during the year 1976 and 1977. The bee population was comparatively greater at 10.00 and 12.00 hours than at 14.00 and 16.00 hours. The temperature and humidity have a positive and negative relation with the bee population, respectively.

Sunflower is a highly cross pollinated crop and the pollination depends on insect visitors to a great extent. Out of a number of pollinators recorded, the rock bee Apis dorsata (F.), a regular visitor was observed to be the most reliable pollinator. Kapil et al (1974) observed wide fluctuations in the number of Apis florea (F.), on alfalfa from year to year. According to Lehman et al (1973) bee population varied within each day. With a view to find out the effect of daily temperature and humidity on the population of bees, the observations were recorded daily at different hours of the day during 1976 and 1977. The results obtained are presented in this article.

Materials and Methods

Pollinators visiting the crop during blooming period in all the seasons were collected and identified in Table 1. Observations on the population of A. dorsata were recorded at 8.00, 10.00 and 12.00 hours during the summer and at 10.00, 12.00, 14.00 and 16.00 hours during other seasons, by counting the number of bees on flowers in a plot, and these data were converted to bees per hundred flowers. The temperature and humidity were simultaneously recorded. Weekly averages were calculated for all the three parameters for 1976 and 1977. The observations are presented in Figure 1 to 4.

Results and Discussion

A survey of the sunflower fields during 1973 to 1977 revealed that a large number of insects are associated with sunflower (Table 1) as pollinators with varying degree of importance. Out of these the rock bee A. dorsata was the most important pollinator.

Temperature and humidity have marked effect on the behavior of A. dorsata which ultimately results in significant variation in the population during various seasons and different hours of the day.

TABLE 1. Pollinators Visiting Sunflower

S.N.	Pollinator	Order	Family
1.	Chrysomya maoacaphala (F.)	Diptera	Calliphoridae
2.	Orthellia lauta (Weidmann)	"	"
3.	Rhinia discolor (F.)	"	"
4.	Limnophora sp.	"	Muscidae
5.	Musca pattoni (Austen.)	"	"
6.	Physiphora aenea (F.)	"	Otitidae
7.	Sarcophaga (S.E.) sp.	"	Sarchophagidae
8.	Eristalinus sp.	"	Taphritidae
9.	Taphritis sp. No. 1	"	"
10.	Tephritis sp. No. 2	"	"
11.	Anthophora sp.	Hymnoptera	Apidae
12.	A. zonota (L.)	"	"
13.	Apis dorsata (F.)	"	"
14.	A. florea (F.)	"	"
15.	Halictus sp.	"	"
16.	Larsioglossum sp.	"	"
17.	Megachile sp.	"	"
18.	M. albifrons (Smith.)	"	"
19.	M. bicolor (F.)	"	"
20.	M. caphalotes (Smith.)	"	"
21.	M. vera (Nurse.)	"	"
22.	Irigona sp.	"	"
23.	Xylocopa sp.	"	"
24.	Stilbum sp.	"	Chrysididae
25.	Odynerus sp.	"	Eumenidas
26.	Campsomeriella collaris (F.)	"	Scoliidae
27.	Danais chrysippus (L.)	Lapidoptera	Danaidae
28.	Hypolimnas misippus (L.)	"	Numphalidae
29.	Papilio demoleus (L.)	"	Papilionidae
30.	Heliothis armigera (Hb.)	"	Noctuidae

Temperature and humidity have a marked effect on the population of bees.

Effect of temperature during the year 1975

It is evident from Figure 1 that the population of bees reached to a maximum of 43.90 percent with a corresponding temperature of 19.67°C during second week (January) at 10.00 hours, and reduced to 2.60 percent at 16.00 hours with the rise in temperature to 26.00°C. The bee population gradually reduced to 4.10 percent during sixth week (February), with a temperature of 19.10°C at 10.00 hours and it further reduced to 0.81 percent at 16.00 hours at 26.75°C.

With the rise in temperature, the population started building up again and reached its peak of 42.40 percent during fourteenth week (April), with the corresponding temperature of 29.10°C at 10.00 hours. It reduced to 39.32, 33.40, adn 20.46 percent at 12.00, 14.00 and 16.00 hours of the day with the corresponding temperature of 32.40°C, 35.40°C and 36.80°C respectively. Further rise in temperature caused a gradual reduction in population to 9.24 percent during twenty-first week (May) at 36.25°C at 10.00 hours. During eighteenth week (May) with a gradual increase in temperature from 36.33°C to 42.66°C, the population gradually reduced to zero during the day.

As there were no flowers available in the field from twenty-second to thirty-third week (June to August), the population of bees could not be recorded.

From thirty-fourth week (August), the bee population started building up and reached to 24.17 percent during forty-third week (October), with a temperature of 30.00°C at 10.00 hours and it reduced to 7.87 percent at 16.00 hours at 34.67°C. During forty-sixth week (November it reduced to 15.83 percent at 26.33°C at 10.00 hours, and 5.23 percent at 16.00 hours.

During forth-seventh week (November) there was a sudden increase in population to 28.62 percent at 22.90°C and it gradually reduced to zero during fifty-second week (December) at 18.40°C at 10.00 hours, whereas it increased with the increase in temperature at 12.00 and 14.00 hours and again reduced with the reduction in temperature at 16.00 hours.

Effect of Humidity

Figures 1 and 2 denoted that the bee population was 43.90 percent with corresponding humidity of 70.00 percent during second week (January), at 10.00 hours, and reduced to 2.60 percent at 16.00 hours with a reduction in humidity to 48.66 percent. It reduced to 4.10 percent during the sixth week (February) at 10.00 hours, although the humidity was 74.33 percent and it reduced to 0.81 percent at 16.00 hours. During the seventh week (February), with the decrease in humidity to 72.60 percent at 10.00 hours the population increased to 28.68 percent, which reduced to 24.65 percent with an increase in humidity to 79.60 percent during eighth week (February).

With a gradual decrease in humidity from 47.00 percent to 44.60 percent from ninth to fourteenth week (February to April), the population increased from 20.61 percent to 42.40 percent at 10.00 hours. At 16.00 hours also, the population increased with fall in humidity. During eighteenth week (April),

FIGURE 1. Bee Population in Relation to Temperature During 1976.

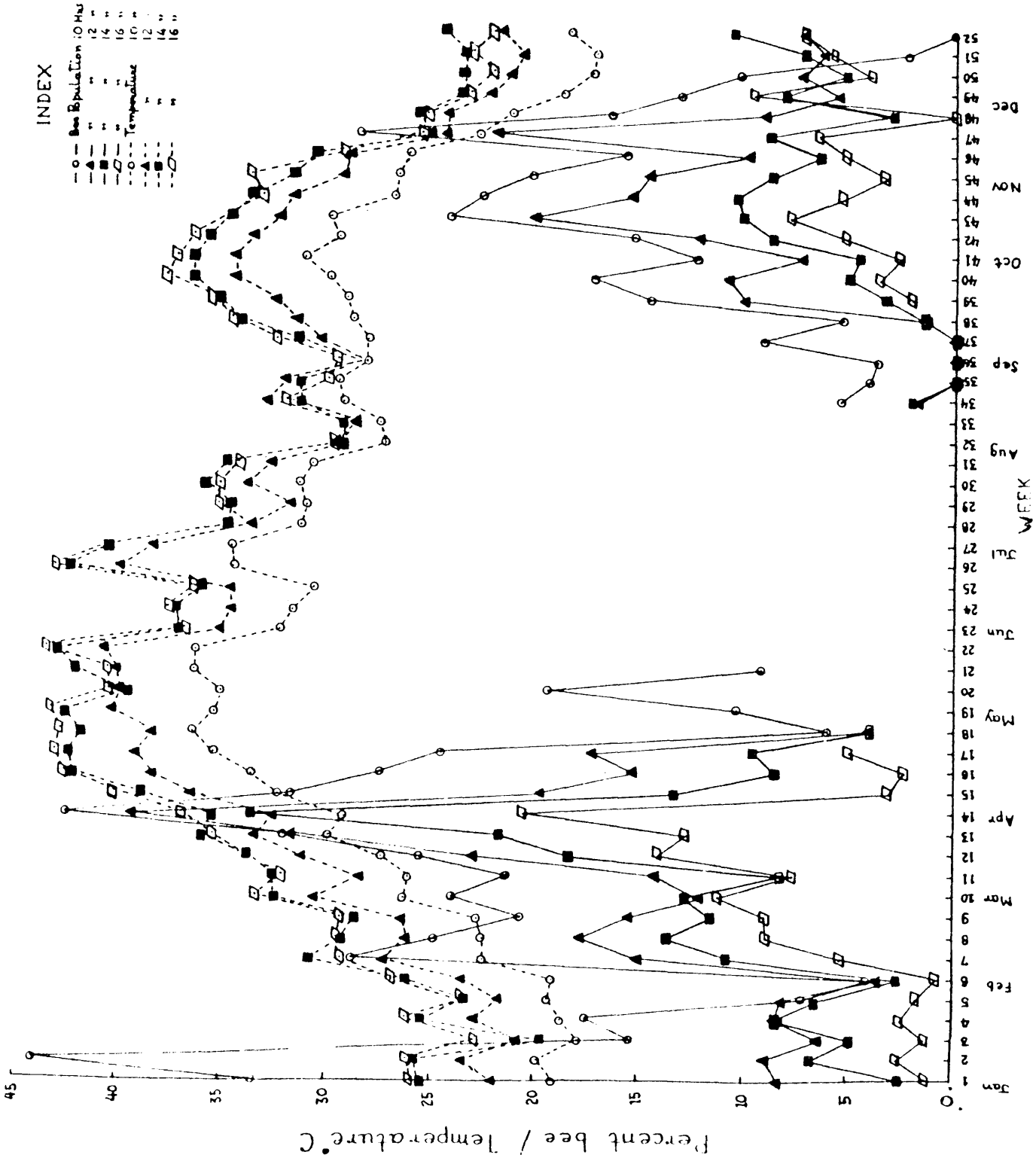
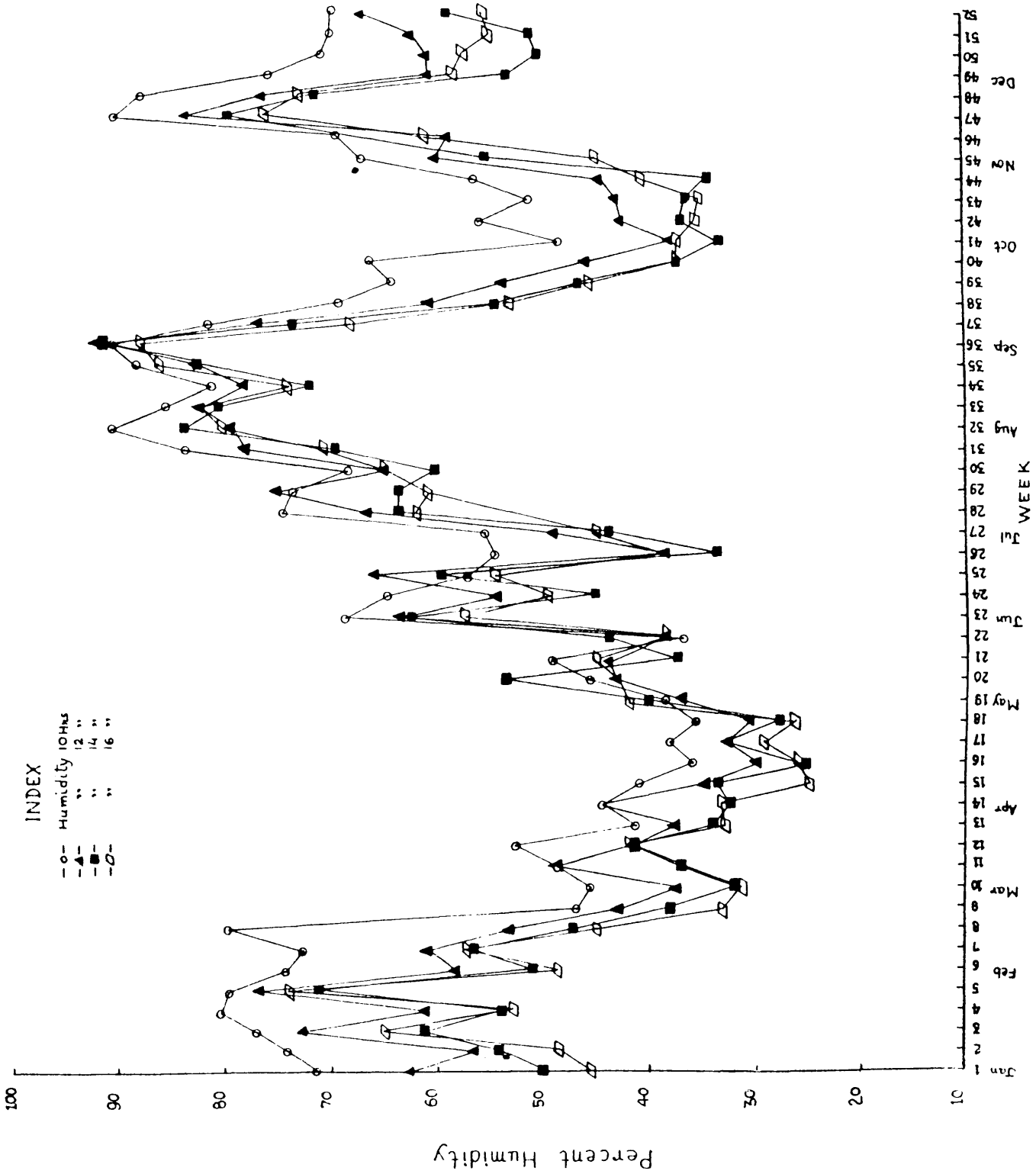


FIGURE 2. Percentage Humidity During 1977.



the population was 5.98 percent at 35.66 percent humidity at 10.00 hours and it reduced to zero at 16.00 hours with the reduction in humidity to 26.33 percent.

As there were no flowers available in the field from twenty-second to thirty-third week (June to August), hence the bee population could not be recorded.

During the thirty-fourth to thirty-sixth week (August and September) there was an increase in humidity from 81.20 percent to 90.40 percent; simultaneously, there was a gradual reduction in bee population from 5.47 percent to 3.78 percent at 10.00 hours.

During the thirty-seventh to forty-third week (September and October) there was a gradual reduction in humidity from 81.50 percent to 51.67 percent at 10.00 hours; correspondingly the bee population increased from 9.25 percent to 24.17 percent, at 10.00 hours. Similar trend of increases in population was observed at 12.00, 14.00 and 16.00 hours with a decrease in humidity.

From forty-fourth to forty-sixth week (October and November), with the rise in humidity from 56.83 percent to 69.67 percent, there was a gradual reduction in bee population from 22.70 percent to 15.83 percent at 10.00 hours. Similar trend reduction was followed at 12.00 and 14.00 hours of the day.

During forty-seventh to fifty-second week (November and December) with the decreases in humidity from 90.50 percent to 68.50 percent, the bee population reduced from 28.62 percent to 0.00 percent at 10.00 hours. Almost similar trend of bee population was observed at 12.00, 14.00 and 16.00 hours.

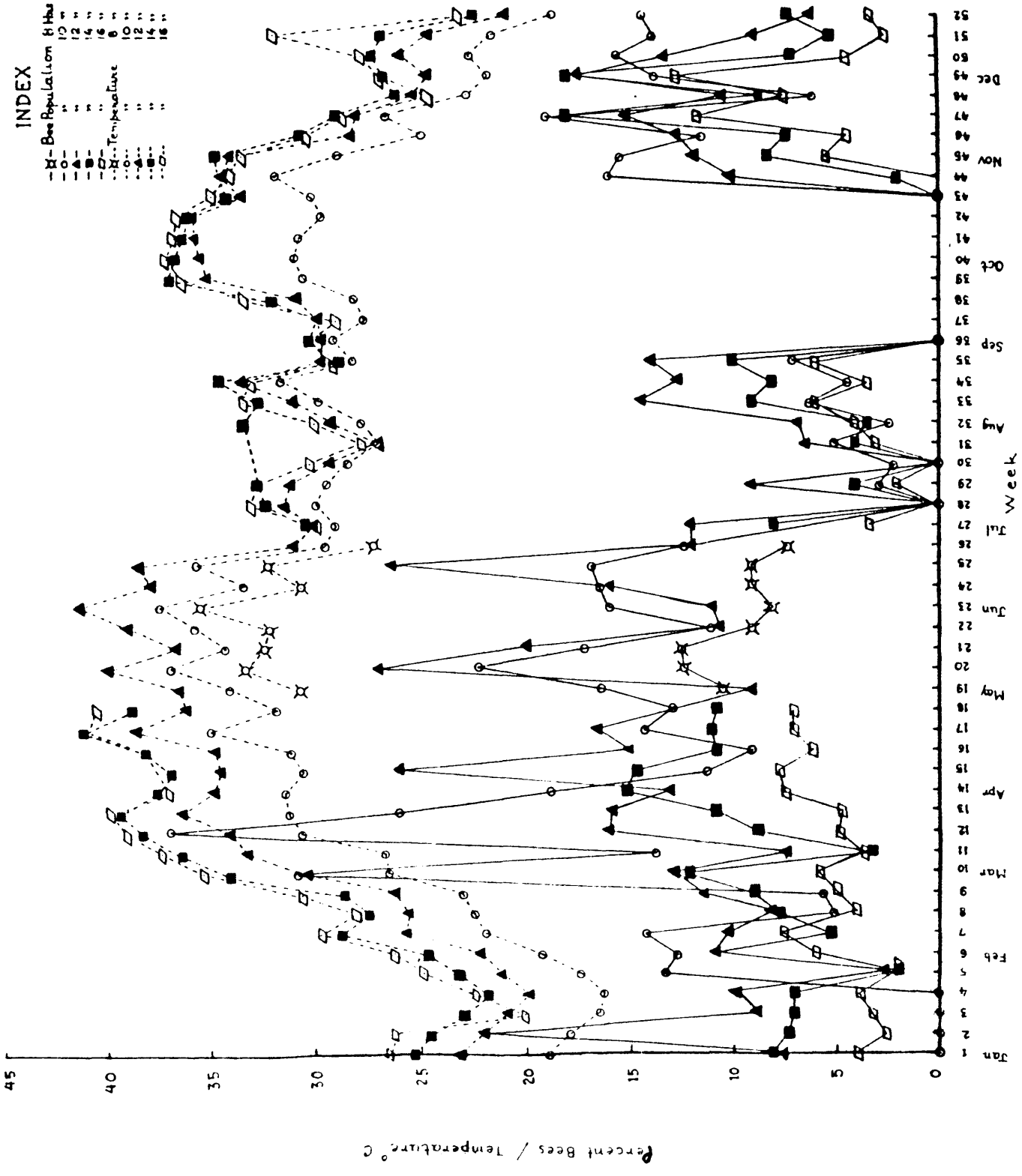
During this period there was no wide variation in humidity, therefore, the reduction in population may be attributed to the gradual reduction in temperature from 22.90°C to 18.62°C, which appears to be a more important factor in governing bee population than humidity. Almost similar trend of bee population was observed at 12.00, 14.00 and 16.00 hours.

Effect of temperature during the year 1977

It is evident from Figure 3, that during first to fourth week (January) there were no bees at 10.00 hours when the temperature ranged from 16.30°C to 19.00°C but with the increase in temperature at 12.00 and 14.00 hours. There was considerable increase in bee population which was reduced at 16.00 hours, although the temperature was a little higher than at 12.00 and 14.00 hours. During fifth week (January), the population was 13.3 percent at 17.40°C at 10.00 hours and it reduced to 2.67, 2.00 and 2.00 percent with the rise in temperature at 12.00, 14.00 and 16.00 hours respectively. It increased to 37.00 percent during twelfth week (March) at 30.60°C at 10.00 hours and the population decreased during different hours of the day.

There was a gradual fall in population to 9.00 percent with a temperature of 31.25°C, during sixteenth week (April), at 10.00 hours, it increased to 22.33 percent during twentieth week (May), at 10.00 hours with the rise in temperature to 37.00°C. With the increase in temperature to 40.00°C there was a considerable increase in population at 12.00 hours.

FIGURE 3. Bee Population in Relation to Temperature During 1977.



During summer months the population at 8.00 hours was comparatively low ranging from 7.30 percent to 12.4 percent, with a temperature of 27.16°C to 32.40°C, whereas at 10.00 and 12.00 hours it increased with the rise in temperature. The bee population was reduced to zero during twenty-eighth week (July), at different hours of the day at a temperature ranging from 30.00°C to 33.00°C. There was a gradual increase in population to 7.00 percent during twenty-ninth to thirty-fifth week (July and August), when the temperature ranged from 27.00°C to 31.66°C at 10.00 hours.

As there were no flowers available in the field from thirty-sixth to forty-third week (September and October), the population of bees could not be recorded.

From forty-fourth to forty-seventh week (November), there was a gradual decrease in temperature at 10.00 hours, and simultaneously the population increased from 15.43 percent to 18.95 percent. Similar trend was observed at 12.00, 14.00 and 16.00 hours. During forty-eighth to fifty-second week (December), with the decrease in temperature from 22.80°C to 18.40°C, the population increased from 6.02 percent to 15.55 percent at 10.00 hours. But the population was fluctuating at 12.00, 14.00 and 16.00 hours with the decrease in temperature.

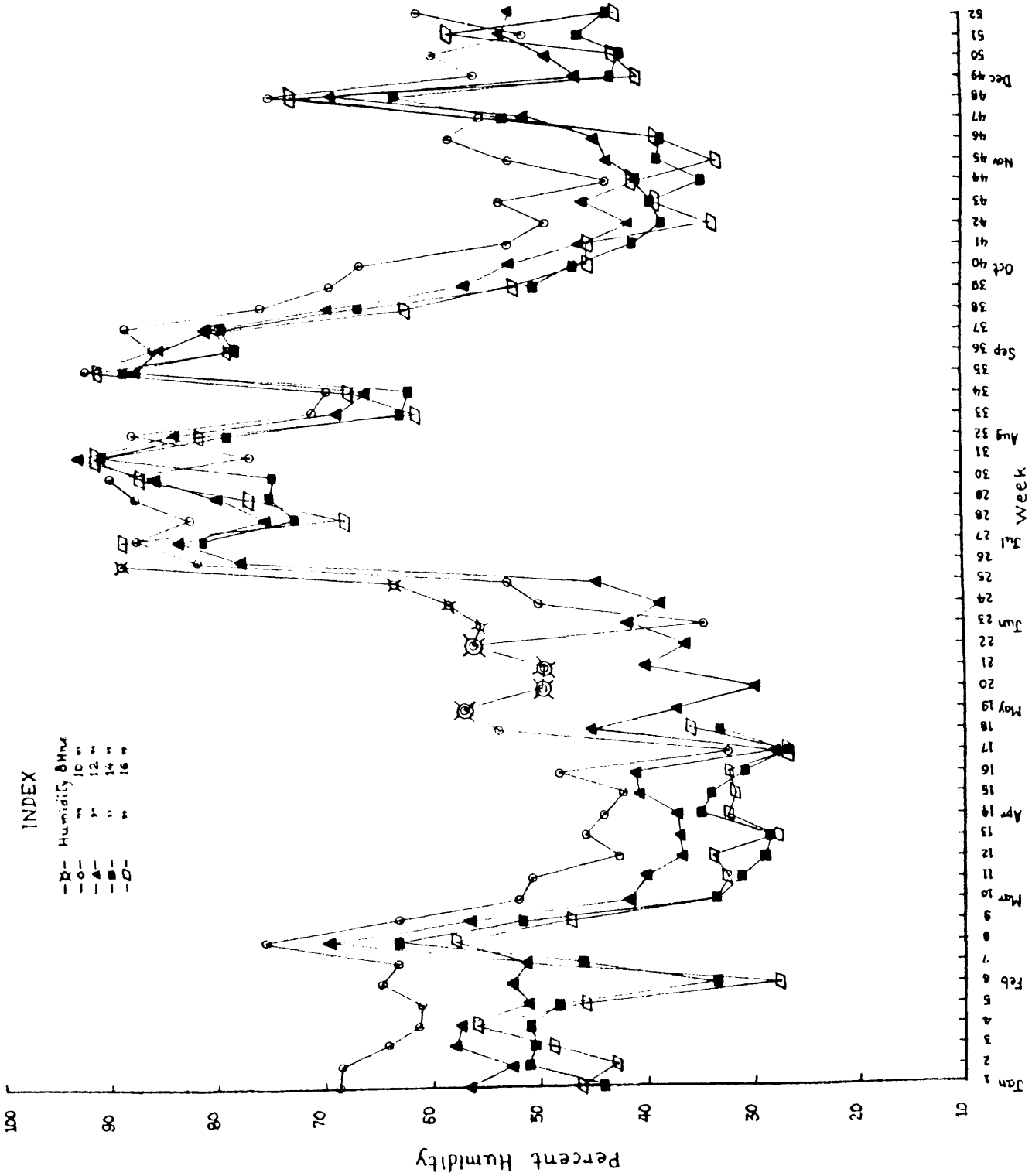
Effect of humidity

Figures 3 and 4 for the year 1977 showed that there were no bees during the first to fourth week (January), with a humidity of 61.20 percent to 68.60 percent at 10.00 hours; there was a considerable increase of population at 12.00 hours which reduced to 2.63 percent at 16.00 hours, with the gradual decrease in humidity at different hours of the day. The bee population reached to 13.30 percent during fifth week (Febraury), with a humidity of 61.00 percent at 10.00 hours, which further reduced to 2.0 percent at 16.00 hours with a humidity of 45.60 percent. With the fall in humidity from 61.00 percent to 42.70 percent the population reached to a maximum of 37.00 percent during the twelfth week (March), at 10.00 hours and reduced to 4.82 percent at 16.00 hours with 33.60 percent humidity. The population reduced to 9.00 percent during sixteenth week (April), with the rise in humidity to 41.00 percent. The bee population further increased to 22.33 percent during twentieth week (May), with 49.70 percent humidity at 10.00 hours, and it increased to 27.00 percent at 12.00 hours with reduction in humidity to 29.30 percent. The population during summer months up to twenty-sixth week (June), ranged from 7.30 percent to 12.40 percent with a humidity ranging from 35.50 percent to 88.50 percent at 8.00 hours. At 10.00 hours the population was higher, although the humidity was almost similar to that of 8.00 hours, whereas at 12.00 hours the population increased with the reduction in humidity.

The population reduced to zero during the twenty-eighth week (July), with 82.16 percent humidity at 10.00 hours, similar trend of population was recorded at 12.00, 14.00 and 16.00 hours. During twenty-ninth to thirty-fifth week (July), the population was low in general at different hours of the day with the rise in humidity.

As there were no flowers available in the field from thirty-sixth to forty-third week (September and October), the population of bees could not be recorded.

FIGURE 4. Percentage Humidity During 1977.



From forty-fourth to forty-seventh week (October and November), the humidity varied from 43.50 percent to 58.50 percent at 10.00 hours and the population ranged from 11.44 percent to 18.95 percent. At 12.00, 14.00 and 16.00 hours the population increased. With the rise in humidity from forty-eighth to fifty-second week (December), the humidity and the population were fluctuating at different hours of the day.

Conclusion

It may be concluded that bee population was more at 10.00 and 12.00 hours almost throughout the year except between twenty-eighth to thirty-sixth week (July to August), where the population was comparatively lower at 10.00 hours than at 12.00 hours. The temperature during this period varied from 16.30°C to 37.50°C and 19.80°C to 41.40°C at 10.00 and 12.00 hours respectively.

During summer the optimum range of temperature and humidity observed favorable for the pollinators was 22.66°C to 37.50°C and 27.58 percent to 87.16 percent, whereas in winter, it was 17.50°C to 32.00°C and 43.50 percent to 71.00 percent respectively.

It has also been concluded that the temperature was in positive relation with bee population whereas the humidity was in negative relation.

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