clearly than another it is the compendiousness of the work. Hardly a question has arisen relative to advertising which is not referred to in the voluminous index. The answer is given if it can be truthfully stated. There are, however, many gaps in our knowledge, as Professor Starch would be only too willing to admit. And it is hoped that the excellent guidance which he has furnished in this book will stimultae workers in advertising to make the further investigations that are so greatly needed.

HARRY D. KITSON

LABORATORY APPARATUS AND METHODS

REMOVING JELLY FROM FROG OR TOAD EGGS

THE quantity of jelly surrounding the egg of the frog or toad is always a source of annoyance in laboratory study. The physical and chemical methods already in use are quite unsatisfactory and the writer has been trying for several years to find some process as free as possible from their defects. Professor C. I. Nelson, of the Department of Bacteriology of the North Dakota Agricultural College, suggested that "antiformin" as used in dissolving tuberculous sputum might be successful and it has proved wonderfully effective. It is inexpensive and sufficiently stable for a stock solution to last through the spawning period of the frog. For convenience the formula is given below.

Washing soda	2 pounds
Chloride of lime	1 pound
Water	1 gallon

Use the supernatant fluid from this mixture (or filter) and mix with equal parts of a 15 per cent. solution of sodium hydroxide. The egg masses in my experiments were first fixed in a 10 per cent. formalin solution.

100 to 125 cc is sufficient to dissolve the jelly on one clutch of eggs. The action is complete inside of ten minutes. The eggs are thoroughly washed in 8 or 10 changes of water and allowed to stand in water for a half hour or longer to remove any traces of the antiformin. The eggs are then passed through a series of alcohols to 70 per cent. where they are kept. After 12 or 24 hours they are slightly bleached to bring out the cleavage lines through the addition of a few drops of peroxide of hydrogen to each batch. If the eggs are subjected to bleaching before they have been hardened in alcohol there seems to be some tendency for disintegration. A few eggs tend to break up, but the majority remain in perfect condition. Three or four batches may be stored in an eight ounce bottle, whereas before the removal of the jelly a quart jar would be necessary to hold them.

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SPECIAL ARTICLES

CONDITIONS OF NATURAL SELECTION

OBJECTORS to natural selection seem only to have substituted variation or mutation for special creation and to hold that species were produced first and then dropped into the situations to which they were adapted. With them the origin of species is the same as that of distinctive characters. Species, it seems to me, are not dried things which may be separated by certain differences, but living things which occupy definite ecological positions, and that they separated first and got their differences afterwards.

Natural selection is an ecological theory. What it will account for must be ascertained by ecological investigation. Diversifications of food habits and of geographical and phenological ranges are its most important conditions.

Food habits.—One species of bee gets its pollen from flowers of one species, while another gets its pollen from those of another species. Two species are inquilines of different hosts. Of 182 local species of lower Aculeata whose flight is pretty well made out, 158 fly simultaneously, July 25-27. But for the fact that they provision their nests with different kinds of insects, so many species could hardly thrive in one place and fly at the same time.

Phenological range.—One species of bee flies in the spring, another in the fall. Of 296 local species, only 47.2 per cent. are flying simultaneously. Of 470 insect flowers, only 42.7 per cent. bloom at one time.

Geographical range.—It seems to be a general law that the most closely related species do not live in the same place. This is one of the most important facts in geographical distribution. In the case of 1,428 local species, mentioned in SCIENCE 48: 369, an average of only 1.7 belong to the same genus. The genera with more than one species are usually represented by the most divergent forms. The Bembicidae show only 10.4 per cent. of the North American species, but 83.3 per cent. of the genera. Of 79 families of insect flowers, compared with the same families given in Gray's Manual, 7th edition, the local flora shows 21.9 per cent. of the species and 44.1 per cent. of the genera. These estimates were suggested by the presumption that the most closely associated elements ought to be the most heterogeneous. The closer the competition is, the greater the generic diversification.

The early flora.—The composition of 159 species blooming before July and 162 blooming after June, shows the following percentages:

Trees	Woody climbers	Shrubs	Acaulescents	Climbing herbs	Other perennials	Annuals biennials
11.9	5.6	9.4	15.0	1.2	44.0	12.5
0.0	0.0	1.2	0.0	8.0	71.6	19.1

The first set has 1.7 species to the genus and 3 to the family, the second 2.8 to the genus and 5 to the family. The phenological specialization of the first set is marked by an average of 38.9 days, while the second shows an average of 59.5 days. Of the former 72.9 per cent. are in bloom on May 12, while of the latter 81.9 per cent. are in bloom on August 22. The Sympetalae change from 22.0 to 68. 5 per cent. The diversification of the early flora was also manifested in the production of anemophilous plants. These belong to early groups. Of Illinois anemophiles about 95.4 per cent. are monocotyledons and Archichlamydeae. In a similar way, most of the aquatics, though blooming late, belong to monocotyledons and Ranales. The early flora, along with its age, shows the diversification effected by natural selection.

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FACTORS WHICH INFLUENCE THE APPEARANCE OF THE SEXES IN PLANT LICE

THE observations of Marcovitch (SCIENCE, No. 1913, p. 537, December 28, 1923), on the influence of the relative length of day on the production of the sexes in aphids raise the important questions of the parts played by the influence of food and temperature.

It appears from the article referred to above that Marcovitch is of the opinion it is the relative length of time the insects are exposed to daylight which is the important factor. It seems to the present writer, however, that, since reduction of the time period in which the plants are exposed to the light will reduce the photosynthetic activity of the plant, the feeding value of the sap will be affected.

Artificial light can be produced rich in those rays which are of value in photosynthesis and one would expect that, since it is the short hours of daylight which stimulate the production of the sexuales in autumn, by increasing the hours of light over the period when normally sexual forms appear, one would inhibit their appearance.

The present writer, holding the view that the light factor may be important in so far as it affects the photosynthetic activity of the plant, carried out an experiment in 1922 with colonies of a pure line of *Aphis rumicis* L. reared on *Vicia faba.*

The experiment was carried on over a period of three months, November, 1922, to January, 1923, and artificial lighting was obtained by means of two 500 c. p. tungsten filament lamps. The aphids were exposed to eight hours' illumination daily, beyond the ordinary hours of daylight. Control colonies only received the ordinary daylight. Temperature charts were kept throughout the experiment. It is interesting to note that although sexual forms had appeared in the colonies in October, only agamic individuals were produced throughout the experiment. Reproduction was fairly rapid, and practically all the aphids produced were apterous agamic females. An examination of the results indicates that temperature was an important factor in this experiment. The experiment was stopped on January 15, and the aphids were kept under normal daylight conditions at a lower temperature. Under these conditions sexual forms appeared in the generations from February 10 to June 10, after which date only agamic forms were produced. On October 3 sexual forms again appeared.

It will be noted that sexual forms were obtained in the colonies in early June, the evidence indicating that temperature was the factor concerned. In any case the hours of daylight were almost at the maximum.

Experiments have been carried out at Rothamsted during the past three years with a pure line of *Aphis rumicis,* the detailed results of which will shortly be published. The results afford considerable evidence that, at any rate with this species in Britain, the appearance of the sexes is associated with a periodic rhythm. The period from middle October to the middle of April is the period during which there is a strong tendency for sexual forms to appear in the colonies.[1] On the other hand, during the period from the middle of April to the Middle of October, the tendency is for agamic females only to appear. This periodic rhythm under experimental conditions is somewhat elastic, and sexual forms have in fact been obtained in most generations extending from the end of September to the beginning of June.

It is clear that the maximum agamic reproduction occurs over the favorable months of the year, and it seems highly probable that sunshine, temperature and length of day are influential factors.

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[1] It will be understood of course that normally out of doors the agamic individuals die out in the autumn, owing to climatic conditions; the winter eggs having been laid, hatch out the following April. Experimentally, however, with favorable food and temperature conditions, a few agamic individuals are usually produced together with the sexuales and these carry on the next generation.