

APPLICATIONS must be on file with the United States Civil Service Commission at Washington, D. C., not later than August 14 for the positions of senior engineer with a salary of \$4,600 a year; of engineer, with a salary of \$3,800 a year; of associate engineer, with a salary of \$3,200 a year, and of assistant engineer, with a salary of \$2,600 a year. Vacancies in these positions in Washington, D. C., and in the field, and in positions requiring similar qualifications will be filled from these examinations, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer

or promotion. The salaries given above are subject to a deduction of $3\frac{1}{2}$ per cent. toward a retirement annuity.

THE National Research Council has continued for the fiscal year 1939-40 its subscription to a table in the Naples Zoological Station. Qualified investigators wishing to enjoy the facilities of the Naples Laboratory should make application to the office of the Division of Biology and Agriculture, National Research Council, 2101 Constitution Avenue, Washington, D. C.

DISCUSSION

PRESENT-DAY BOTANY IN ITALY

A MUCH-BELATED number of the *Nuovo Giornale Botanico Italiano* (Vol. 45, No. 1) celebrates the fiftieth anniversary jubilee meeting (1938) of the founding of the Italian Botanical Society and the two hundredth anniversary of the death of the distinguished Florentine botanist, Pier Antonio Micheli (1679-1737). Addresses by the president of the Botanical Society, Professor Napoleone Passerini, and by the secretary, Professor Alberto Chiarugi, describe the founding of the organization and its fifty years' accomplishments. The society now has 209 members, most of them in the neighborhood of Florence and Pisa and in northern Italy, but some in every province of the kingdom. The published "commemorative oration" by Professor Giovanni Negri is an appreciative twenty-five-page account of the life and work of Micheli, "father of mycology," author of "Nova Plantarum Genera."

The publication includes about thirty contributions in various fields, as: morphology, anatomy, physiology, mycology, ecology and geographical botany. Among the longer articles is one by Rodolfo P. Sermolli, describing and illustrating with three full-page plates some features of the vegetation in higher mountain districts of Italian East Africa. Adriano Fiori lists the plants of a number of the Italian Aegean Islands. Raffaele Ciferri gives an account of the rediscovery of *Emericella varicolor* (Eurotiaceae), a fungus on rotting olive fruit. Ciferri and Giglioli propose a "formula"—based on a definite schedule of description—for describing varieties and forms of wheat. Roberto Corti reports upon collections of plants from Cufra and other oases in southeast Libya and farther south in Tibesti.

This jubilee publication gives some idea of present-day botanical activity in Italy, although it must not be forgotten that there are other Italian botanical journals, besides special publications of some of the universities. The work of Italians in horticulture, agri-

culture and forestry is somewhat well known in the United States, but their botany has generally received less attention from Americans than it deserves.

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THE PRODUCTION OF UNFERTILIZED SEEDS IN TRILLIUM

TRILLIUM has always been used as an admirable object for cytological investigations on account of the huge size of its chromosomes. This genus, which is found in North America and in Asia, presents cytological peculiarities in both continents. The descriptions of its meiotic divisions reveal extreme irregularities and a large amount of sterility. It has been supposed that these abnormalities were due to the intolerance on the part of the genus to cultivation. The present authors have satisfied themselves that this is not the cause of the irregularities, since they are present just as strikingly in material gathered from normal wild plants as in those under cultivation. As a result of the investigations of the processes leading to the formation of the embryo, in certain species of the genus it became clear that in contrast to the dandelions and hawkweeds (*Hieracium*) apomixis rather than parthenogenesis is present. The reduction division in the embryo sac mother cell is quite normal in contrast to the situation in the pollen mother cells, and five chromosomes are present. One of the derivatives of the mother cell survives, as is usually the case, and gives rise to an embryo sac. Ordinarily this contains only four nuclei, a situation paralleled by the *Onagraceae* and allied forms, as well as by certain orchids. Of the four nuclei one becomes the egg and another an abortive synergid. The remaining two nuclei fuse together and form the endosperm nucleus. The pollen tubes usually do not penetrate the ovary and in the rare cases that this happens, they do not effect fertilization. There is as a consequence no fecundation of either the egg or the endosperm as a result of

fusions effected by nuclei from the pollen-tube. In spite of the absence of fertilization the egg develops into an abortive embryo in which the divisions show five chromosomes; in other words, the embryo is haploid. This embryo does not attain any considerable size and ultimately aborts. The endosperm, which is diploid as a result of its method of origin, forms in the usual manner and first contains a large central cavity around which are rapidly dividing cells. After the abortion of the haploid embryo and after the endosperm has reached considerable degree of development, a diploid embryo makes its appearance in the micropylar region of the endosperm and is continuous with the endosperm tissues. This is the embryo which perpetuates the plant. Frequently with the abortion of the haploid embryo the whole seed aborts. In other cases the seeds may reach a certain size without any embryos in them at all and in a number of instances what appear superficially to be seeds, even when relatively mature, do not contain an embryo. In certain cases all the seeds in an ovary may be in this condition. In all the mature seeds examined by the present writers in the following species of *Trillium* embryos produced from the endosperm were found to be present: *T. grandiflorum*, *T. erectum*, *T. undulatum* and *T. sessile*.

It would appear from the abnormal method of reproduction in *Trillium* that too great importance can not be attached to the reproductive chromosomes of the anthers and their behavior.

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THE ROLE OF ARRHENOTOKY IN THE ADAPTATION OF INSECTS

THE sperms of Hymenoptera appear to be only female-producing. The lack of male-producing sperms is correlated with the production of males from unfertilized eggs, a form of parthenogenesis known as arrhenotoky. Since the production of females in arrhenotokous Hymenoptera only takes place after mating and since oviposition in many species occurs as readily before as after mating, a preponderance of males might be expected. Actually, however, arrhenotokous Hymenoptera as a rule produce more females than males.

This preponderance of females is possible because of the presence in insects of a mechanism for the storage and conservation of sperms. This mechanism consists of a spermatheca (sperm reservoir), the spermathecal gland, the sperm duct and associated nerves and muscles. The primary function of this mechanism is to discharge a limited number of activated sperms upon each egg as it passes down the oviduct. When a species produces males from unfertilized eggs this mechanism automatically becomes the means of controlling the proportion of the sexes. When it func-

tions females are produced; when it fails to function males are produced.

The fact that, in the Hymenoptera in general, there is a preponderance of females shows that mating usually occurs before oviposition and that the spermatheca contains sufficient sperms to fertilize most of the eggs. Since male progeny also are produced by the female before its supply of sperms is exhausted, it is evident that some stimulus other than the mere passage of the egg through the oviduct is needed to cause the discharge of sperm in Hymenoptera. This operation appears to be dependent on two sets of reflexes: one involving the spermathecal gland (the stimuli originating externally); the other the spermathecal muscles (the stimuli originating internally with the movement of the eggs through the oviduct). The glandular reflex apparently serves to activate the stored sperms; the muscular reflex apparently synchronizes the discharge of sperms with the expulsion of the egg. Lack of fertilization results either from inadequate stimulation, an excessive rate of oviposition or lack of sperm.

Since in the Hymenoptera the activation of sperms is a result of environmental stimulation, it is evident that the environment controls the sex ratio in most species. As a result of such control extreme variability characterizes the sex ratio in this group of insects.

The fact that, in general, there exists a preponderance of females indicates a remarkable adaptation to environment.

In this connection it is interesting to note a phenomenon which occurs in a few species of Hymenoptera and is correlated with the preponderance of females. This is intra-specific hyperparasitism: a phenomenon also dependent on arrhenotoky. In this type of parasitism all the males, in most species, are the progeny of unmated females and in pure cultures are obligatory parasites of the immature stages of the female. The females are obligatory parasites of scale insects and mealy bugs. Male hyperparasitism, however, is not necessarily entirely intra-specific. In at least one species the male appears to be an obligatory inter-specific hyperparasite, rarely, if ever, parasitizing the immature female of its own species. Such a species would be unable to reproduce in pure cultures. The hyperparasitic males develop under diverse environmental conditions. In extreme cases the males develop only ectoparasitically in a dry environment, whereas the female develops endoparasitically in a fluid environment. The adults of both sexes frequent like environments.¹

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¹ *Ann. Ent. Soc. of Amer.*, 32: 11-26, 1939; *Univ. of Calif. Publ. in Ent.*, 6: 401-422, 1937.