industries. We can keep this increased trade only if we maintain West Indian production and, what is quite as urgent, improve West Indian grades so that they can compete with the Mediterranean. This may or may not be achieved by means of sponge culture, but it is worth trying. The Americans have undoubtedly made progress with sponge culture in Florida, and a significant fact is recorded in a recent British Colonial Report on the Turks and Caicos Islands to the effect that at one of these islands 8000 acres of sea for sponge culture has been conceded to a capitalist from New York. While we should prefer to see British enterprise of this nature, particularly in a British Possession, we have to recognise a certain consistency in United States action. Most of the marine investigation in the West Atlantic has been American; for instance, Prof. Nutting's recent and former expeditions, the study years ago on the fishes of Porto Rico by the U.S. Government, and the quite recent oceanographic work in the steamer *Bache*. It is to be hoped that Great Britain will see its way to take up the sponge question, first from the scientific, and then from the commercial, point of view, and that a start will be made at the earliest possible date. W. R. DUNLOP.

Seaholme, Hythe, Kent, April 23.

Wasps.

THE warm spring weather which made its advent on Good Friday (April 18), and was continued on following days, brought out numbers of humble-bees, a few wasps, and butterflies of various kinds. I have usually observed that the humble-bees precede the wasps by a week or two.

A wasps' nest (*Vespa germanica*) situated in the garden here in 1915 was a rather strong one, and on digging it out in October I estimated the number of cells as 12,900. A nest of the same species which I had in 1918 was much stronger. In 1915 the hourly number of wasps flying in and out of their nest was 6500 at the most abundant period, while in 1918 the rate was no fewer than 15,500. The record heavy rains of September last, however, swamped the nest and brought it to a premature termination, when but few of the young queens had taken to flight. If the nest of 1918 had a number of cells proportionate to that of 1915, according to the hourly rate of wasps flying to and fro, then the total number of cells must have been about 30,000; but I prefer to take a more moderate estimate, and to put the aggregate at 25,000. I could not, however, actually determine the number by observation, the layers of comb being so soaked with the wet that they did not admit of detailed investigation. If each cell produces three generations of wasps, then my nest of 1918 must have been responsible for quite 75,000 wasps. Needless to relate, house-flies were not troublesome in this neighbourhood during last summer! But which pest of the two, wasps or house-flies, is the more tolerable? For my part, I greatly prefer the wasps!

Can any reader inform me as to the number of wasps supposed to be associated with a very strong nest? W. F. DENNING.

Bristol.

THE LUNAR TIDE IN THE ATMOSPHERE.

TIDAL theory was first applied with any success to the atmosphere by Laplace, and he also first attempted to determine the tidal variation of pressure from barometric observations. His material consisted of 4752 measurements of the height of the mercury column at Brest (lat. 49° N.). These were far too few for the purpose, however, and his result, given in tome v. of the "Mécanique Céleste," cannot be regarded as a determination of the quantity sought for, which is much smaller than Laplace's value. Another lunar reduction of barometric data from Brest was made about thirty years ago by Bouquet de la Grye, but his series of observations (consisting of hourly values extending over a few years), while larger than that used by Laplace, still seems to have been inadequate. He arrived at a lunar daily inequality of pressure which was not by any means nearly semidiurnal in type, though the semidiurnal component—0·020 sin $(2t + 100^\circ)$ mm. of mercury—was larger than the probable true value of the tidal variation at Brest.

The atmospheric tide was determined from a *tropical* series of barometric records so early as 1847. There now exist more or less trustworthy determinations for five tropical stations—St. Helena, Singapore, Samoa, Hong-Kong, and Batavia. The results for the two last are from long series of hourly observations, extending over thirty or more years, and are therefore of considerable accuracy. Though the tidal barometric variation has its maximum value at the equator, its magnitude there is very small. At Batavia (6° S.) it may be represented by the formula

$$0{\cdot}065 \sin (2t + 65^\circ) \text{ mm. of mercury,}$$

where t denotes time reckoned from lunar transit at the rate of 360° per lunar day. The phase angle 65° indicates that maximum pressure occurs nearly an hour after the moon crosses the meridian.

Until recently the only determination of the tide which could be considered as probably an approximately true one, among the results for extra-tropical stations, seems to be that obtained by Morano from five years' hourly barometric observations at Rome (42° N.). Though the series of data was not large, the resulting amplitude and phase agree with what might be expected in this latitude. Many other attempts to determine the tidal barometric variation in European latitudes have been made without success. The most important of these investigations was due to Airy, who dealt with as many as 160,000 hourly observations of the barometer at Greenwich (51° N.), ranging over the twenty years 1854–73.

The barometric pressure is affected by a solar semidiurnal variation as well as, and of much greater amplitude than, the lunar tidal variation. Unless the former is properly abstracted from the hourly values before deducing from them the lunar inequality, the determination of the latter may be seriously affected by a residuum of the solar term. Two other causes operate to enhance the difficulty of detecting the lunar variation in the barometric records of stations in moderate and high latitudes. The first is the rapid diminution of the tidal amplitude as the latitude λ increases. The second is the increase in the irregular fluctuations of the pressure. At Brest or Greenwich these range over several millimetres (of the mer-