numbered trees from the Gardens (namely 94 VI. C.), was already published by us in 1894 in KOORDERS en VALETON, Bijdragen Booms. Java I, p. 240, under the correct name Sloanea javanica (Miquel) Sszyszylowicz.

An old garden collection-label of a sterile herbarium specimen of tree 92 (VI. C.) indicates, that its numbered Hortus-tree was formerly cultivated under the incorrect, and as far as I know unpublished garden name of *Elaeocarpus stipularis Bl. var. latifolia.*

Habit. In the fruiting season this forest giant with a trunk, more than 1¾ metres in diameter, is very striking. The dark green crown is then adorned by numerous fruits, almost as large as fists, externally orange, internally a beautiful purple and opening by four valves. These generally contain 1—2, rarely 3—4 glistening jet black, oblong, fairly large seeds, for the most part enveloped by an arillus of a fine orange yellow colour. Except on account of the large dimensions of the trunk, with the large plank-buttresses formed by the roots, this tree is not very conspicuous outside the fruiting season. Young trees easily escape the attention of the field botanist, because this species, even in the sole original habitat so far known, i.e. in the forest of Depok, only occurs very scattered and does not produce flowers and fruits until it has attained an advanced age; a further reason why young specimens are inconspicuous, is that their leaves show such a close resemblance to those of some other Javanese trees, as regards shape, size and innervation, that they are only distinguished after close scrutinizig. The latter reasons explain the fact that the original habitat of Sloanea javanica could have remained unknown for nearly half a century, in spite of its situation near a scientific centre like Buitenzorg, in the forest of Depok, often visited by many botanists.

Buitenzorg, April 9th 1915.

Botany. — *"On the influence of external conditions on the flowering of Dendrobium crumenatum Lindl."* By Prof. F. A. F. C. WENT and A. A. L. RUTGERS.

Dendrobium crumenatum is a small epiphytic Orchid, occurring pretty frequently in the Dutch East Indies, and especially common in Western Java, e. g. at Buitenzorg; it has often attracted the attention of naturalists by peculiarities of its flowering [1]). These

[1]) F. A. F C. WENT. Die Periodicität des Blühens von *Dendrobium crumenatum* Lindl. Ann. d. Jard. bot de Buitenzorg, Supplément II, Leyde, 1898, p. 73—77.

peculiarities are so striking, that the plant has even received a Dutch name and is known in Java as "duifjes", in Singapore as "pigeon orchid". This name refers to the white flowers of a size of about 3 centimetres, which appear simultaneously on many plants and are all the more noticeable, because they remain open only for a single day. Everywhere hundreds of these small, white flowers are seen, which are, moreover, delicately scented. Next day the phenomenon is over and only after several weeks, or even months, the "pigeon orchids" again suddenly appear in full bloom; next day only faded flowers can be found.

We have now studied the phenomenon in question with plants in their native habitat and with others, sent to Utrecht, which were finally cultivated there in two different glass houses. A few results, obtained by us in this manner, are briefly communicated here; for further details we refer to a fuller paper, which will soon be published elsewhere. We wish to emphasize, that we have not succeeded in solving the problem completely, but nevertheless our observations appear sufficient to deprive the phenomenon of its air of mystery.

In the first place we found that the interval between two successive flowering periods is subject to considerable variation; at Buitenzorg minima of 4 and 10 days, and a maximum of 94 days were observed, but in Utrecht the intervals were generally much longer, while in winter flowering cannot be observed at all.

Furthermore it became very evident, that external conditions influence the outset of the flowering. Accordingly the time varies in the East Indies from place to place, and only coincides occasionally for neighbouring places, such as Meester Cornelis, Weltevreden and Menes (March 14th 1913) or Maos, Klampok and Bandjarnegara (March 26th 1913). Likewise the time of flowering often differed at Utrecht in the two glass houses, in which temperature and humidity were not kept equal; on the other hand the flowering period in spring was once found to synchronize in glass houses at Utrecht, Bonn and Hamburg.

When plants, previously grown at a spot A, and hence having definite flowering days, are transferred to a spot B, they acquire another flowering time, which is identical with that of plants grown at B from the beginning. This was found on transporting plants from various parts of Java and from Deli to Buitenzorg and conversely on moving plants from Buitenzorg to Medan. The same change was observed in plants sent from the tropics to the hothouses of European botanic gardens.

With respect to the question, what external factors play a part

in determining the flowering period, it should be noted that the two above mentioned planthouses in Utrecht supply an indication, for here the differences could at most extend to the amount of light, the temperature and the degree of humidity of the air. Observations at Buitenzorg (and also earlier ones at Tegal) have shown that the light may here be dismissed from consideration, for the flowering time is the same for plants growing in the shade as for those in sunny places, although the *number* of the flowers is evidently determined to some extent by the amount of light. Temperature and degree of humidity on the other hand, probably both influence the flowering time, or sometimes the one and sometimes the other of these factors. At Buitenzorg it was occasionally noticed that heavy rains, following a period of drought, soon induced an abundant flowering of *Dendrobium crumenatum*. On the other hand the coincidence of the spring flowering in planthouses at Bonn, Hamburg and Utrecht can only be attributed to the temperature. During winter the temperature of such houses is kept very constant; when in spring the sun becomes more powerful, their temperature rises considerably. It was indeed remarkable, that the above mentioned coincidence was preceded by a period of bright, sunny weather over the whole of Western Europe.

In what way can we now imagine the external conditions to bring about the simultaneous flowering of very different individuals of the same species? The explanation may be as follows: The buds of this *Dendrobium* develop up to a certain stage, but cannot pass it, unless certain favourable conditions are found in the environment, e.g. of temperature or of humidity, or of both; then these conditions, acting for a sufficient time, give an impulse, which carries the buds to their last stage of development; it is further necessary that these last stages should be gone through in a very short time.

What is observed in a state of nature is in complete agreement with this explanation Not only are many flowers found at one time, and few, or even a single one at another time, but different plants do not behave in the same manner. We do not mean by this so much that some plants always flower abundantly and others sparingly (for this is more likely the result of internal disposition, of which we know as yet very little) but rather, that on one and the same plant sometimes many flowers unfold, sometimes only a few. The favourable circumstances were present, but there were not always the same number of buds in the sensitive stage, sometimes not even a single one, so that there are flowering days when a given plant unfolds no flower, other days, when the number of open flowers is

fairly large. Not only do different plants behave very unequally, but the same is noticed on comparison of the various inflorescences of the same plant.

Without careful inspection one gets the impression that the flowers of this *Dendrobium* are solitary in the axils of the leaves; closer observation, however, shows that these axils do not contain a solitary flower, but an inflorescence, of which the axis remains extremely short and generally only a single flower opens at a given time. Sometimes, however, two open flowers are found together in the inflorescence, very rarely even three. Now when careful notes are made as to which inflorescences of a plant produce open flowers at a given flowering period and subsequent flowering data are compared with these, it is found, that in some cases a flower opens in the inflorescence at each time of flowering and that at other times it is left out one or more times. Nor is any order discernible in the combination of inflorescences, which bear open flowers at successive flowering periods. All this was of course to be expected on the assumption that the unfolding of the flowers depends on the presence of buds in a definite developmental stage at the moment that favourable external conditions occur.

The question arises, whether a closer examination of the buds gives any indication as to the nature of this stage of development. The inflorescence is found to arise in the axil of a sheathing leaf without lamina. The young bud is completely surrounded by the sheath and the breaking through of this sheath is evidently difficult. Each bud consists of a number of bud scales and the rudiments proper of the flower. These bud scales completely surround the interior of the bud and present themselves as closed sheaths, which are hard and little permeable — so little, that a bud which has lain in alcohol for some days, does not show internally a trace of this liquid. When the interior of the bud has once broken through these sheathing scales, the latter become fibrous and resemble straw, since hardly anything remains beyond the vascular bundles. Every floral bud is generally cut off from the outside world by two of these scales; these must be broken through before the flower can open. As long as the bud is not longer than 4—5 m.m. it remains between these sheaths; at this stage all the floral parts are easily recognized, although their dimensions are small; only the spur is not yet visible. When the scales are broken through a sudden extension of all the floral parts takes place and after a few days the flowers have opened. Hence just before the flowering a number of buds are found, having a length of 4—5 m.m., while immediately afterwards this number

is much smaller. An investigation at Utrecht on the size of the adult floral buds, just before flowering, showed some diversity, probably connected with the fact that not all buds opened on the same day, and that the flowering extended over two days. This was repeatedly the case at Utrecht, but also at Buitenzorg stragglers are sometimes found, which only open on the day after the general flowering, although it is not so common there as at Utrecht. Probably this is due to a more rapid development under the favourable conditions of the tropics. Careful observation indeed shows, that the opening of the flowers is not absolutely synchronous and that it takes place at different hours; nor is the end of the flowering reached simultaneously, for it may vary by some hours or even by half a day. Moreover the interval between opening and fading is not identical for different flowers.

Attempts to induce flowering experimentally, by a choice of external conditions, have not yet furnished any result. Such attempts are rendered all the more difficult by the necessity of having plants bearing buds at the desired stage of development.

The phenomena shown by *Dendrobium crumenatum* do not indeed, differ fundamentally from those observed in other Orchids. In these also the simultaneous flowering of different plants is often seen, but it is less striking, because the flowering generally extends over days, or sometimes even over weeks and hence one flower may open several days before the other.

Still more generally the flowering of the "pigeon orchids" may even be regarded as the extreme case of what is observed with respect to the flowering of plants in our own climate. Here also, for instance in spring-flowering plants, the floral buds reach an advanced stage of development, which is not passed, until external conditions are favourable and then simultaneous flowering of numerous individuals occurs; the simultaneity is only less striking because the last stages of development are gone through more slowly. Of late these phenomena have been repeatedly investigated, e.g. by KLEBS; a plant like *Dendrobium crumenatum* would perhaps be a suitable experimental object for a further investigation of these cases.

Utrecht, August 1915.