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Djokja - Tengger - Soerabaja

(Botanical trip)

BY

Dr. J. G. B. BEUMÉE

Chief of the Herbarium and Museum for Systematic Botany, Buitenzorg.



Laboratorium voor Plantensystematiek en -Geografie
der Landbouwhoogeschool

Uit de nalatenschap
van
Dr J. Valckenier Suringar

Djokja - Tengger - Soerabaja.

While leaving Djokja by train one can see along the road several tree-species which have not been met with during the journey from Bandoeng to this capital town of one of the still remaining Sultanates of Java. Both the climate and the soil here show a considerable difference from those of the tract from Bandoeng to Djokja. The railway from Djokja to Solo goes over the foot of the Goenoeng Merapi, from which fine volcanic grit is still continually conveyed along the many rivers which flow into a confluent of the river Solo. Dams are cast along these rivers as the level of their beds is higher than the surrounding land. The side river itself seems to be pushed towards the East, to the steep northerly edge of the tertiary Zuidergeberge (southerly mountains). This light grey sandy soil is very fertile, and for the most part can be very well irrigated; it produces much rice, tobacco and sugar.

The rainfall in Djokja amounts to only 3/5 of that of Tjilatjap, and is not so equally divided over the year. During the months June — September the average rainfall is only 50 mm (Tjilatjap 255 mm).

This dry climate is signified by the appearance of *Gossampinus heptaphylla* BAKH. (*Bombax malabaricum* DC.), of which many large smooth stems are to be seen with a dome-shaped crown. By the end of May they have already lost their leaves; after a short interval the bare twigs are covered with great red flowers. The beach-Casuarina (*C. equisetifolia*

FORST.), in habit resembling some Coniferae, may also be counted as a characteristic tree of dry regions, and is frequently planted here in grounds and along the roads.

Tamarindus indica L. with its thick crown of finely pinnate leaves forms beautiful avenues here, as this slowly growing tree only can do in regions with a fairly low rainfall. The mostly crooked *Hibiscus tiliaceus* L. (or the near-related *H. similis* L.) is also seen here. Striking species among the roadside-trees are *Cassia siamea* LAM., which is often cut in the same manner as the pollard-willow, *Samanea Saman* MERR. (*Pithecolobium Saman* BENTH.), with its spreading canopy of dark green leaves, and *Poinciana regia* BOJER (flamboyant) with a thin, very flat head. The decorative waringin (banyan tree, *Ficus Benjamina* L.) has quite another feature.

But a few trees of the former trip are also to be seen here and there, e.g. specimens of *Canarium commune* L., which is the principal tree along the roads in Buitenzorg, and forms there the famous canary-lane in the Botanical Garden.

The white pilose *Calotropis gigantea* R. BR. with pale purple flowers is seen in this rather dry region, at places where the ground is slightly elevated, where the ground-water is therefore deeper under the surface. The kampongs (native villages) are generally surrounded by thick hedges of bamboo (Indian cane). Of the fruit-trees only the protruding *Cocos*-palm can be seen, while an occasional banyan-tree is noticeable against the background of the remaining vegetation. Cemeteries are always planted with kambodja (*Plumiera acuminata*).

After Solo (or Soerakarta) the railway follows the north foot of the Goenoeng Lawoe, where an entirely different groundtexture is immediately noticeable. A little East of Solo the change is seen from the grey sand soil of the Merapi to the much older, and heavier soil of the Lawoe, which did not deposit eruptive matter there for a considerable time. Soon

this Lawoe soil alone covers the whole country. The climate is almost the same as that of Djokja, but the irrigation is much less favourable because of which the landscape has a more xerophile vegetation. Besides the *Gossampinus*, *Samanea* and banyan-trees, some other trees are to be seen again, such as the kajoe koeda (*Lannea grandis* ENGL. == *Odina Wodier*), which remains bare for a long time. For hedges *Pluchea indica* LESS., which comes from after the mangrove, is used, and also *Crescentia Cujete* L. (Bignoniaceae) imported from America. Between the sawahs (rice-fields), now lying dry, the *Sesbania grandiflora* AIT. is often planted, giving a peculiar feature to the landscape by its small thin crowns. Its large white flowers are eaten by the natives as vegetable, whereas the leaves are very good cattle food.

Before Modjosragen black soil is to be seen, which frequently appears further on. MOHR considers it very probable that this black colour is owing to the climate, with its very pronounced dry season. In the wet season the water-movement is principally directed downwards, and the salts, which are then desolved and transferred, will be conveyed to the surface again in the dry season, as the strong evaporation during these months will result in a capillary rising of the ground-water. These alkali-salts give the organic ingredients an intensely black colour, which of course also colours the ground black. This explanation is plausible by the presence of many chalk concretions which can be seen repeatedly from the train along small burrows, as these concretions are built up in a similar manner. The *Acacia tomentosa*, with its flat crowns, is found here as a characteristic tree of such a soil.

Near Walikoekoен a djati-forest is passed through, in which the scattered white pilang stems (*Acacia leucopiloea* WILLD.) draw the attention. Along the forest borders and gardens one finds *Caesalpinia sappan* L., (which produces the dye-wood which was formerly exported in considerable quantities from

Timor). The specimens of *Butea monosperma* TAUB. are also easily recognized by their large shining ternary leaves and their great flame-red flowers on leafless twigs.

On the pasture land of the buffalos (oro-oro) scattered groups of shrubs are to be seen, which are nearly all prickly (*Acacia leucophloea* WILLD., *Randia dumetorum* L., *Flacourtia indica* MERR., *Zizyphus Oenoplia* MILL., *Mezoneurm pubescens* DESF., *Gmelina asiatica* ROXB. var. *villosa* BAKH.), while the *Streblus asper* LOUR. is somewhat protected from the cattle by its sharp short shoots.

To the East and to the West of the capital town Madioen, the immediate surroundings of the railway are entirely taken up by sawahs, but near Saradan on the saddle between Goenoeng Wilis and the low extint volcano Pandan, djati-forests are found instead, while near Ngandjoek (river basin of the Brantas, which is crossed near Kertosono) the greatest part of the country is again taken up by sawahs. The country near Kertosono is low, compared with the Brantas, which carries with it tremendous quantities of Kloet-sand, which causes the river bed to become gradually higher and higher. The ditches along the railway are often entirely filled with *Eichhornia crassipes* SOLMS, which has come from South America.

Just past Modjokerto the great fertile delta of the Brantas begins, which is enclosed between the two river-branches Kali Mas and Kali Porrong, where besides rice, a great amount of sugar-cane is cultivated.

The low land of Sidoardjo, Bangil and Pasoeroean, with soil of volcanic origin, is also a rich agricultural region even though it belongs to the very dry regions of Java.

Pasoeroean has a yearly rainfall of only 1300 mm, the dry season lasting seven months; during the months of July and August the average rainfall is not more than 15 mm. Towards the South (up the foot of the Tengger mountain-mass) the rain-

fall still remains fairly equal over large distances; at Winong 500 m above sea level, the rainfall is scarcely higher than at Pasoeroean. After further climbing a region of high rainfall is reached. Poespo, less than 150 m higher than Winong, has a yearly rainfall of 3000 mm. In the neighbourhood remains are to be seen of the coffee cultivation which was formerly of great importance here, as at many other places on the slopes of the Tengger mountain-mass. The coffee shrubs are found there in a forest of *Erythrina lithosperma* Miq. the orange-red flower of which covers the ground everywhere.

In the dry region, at the N.W. foot of the Tengger, those trees, shrubs and herbs are principally seen again, which were seen before in the surroundings of Djokja and Solo. Beautiful rows of *Tamarindus indica* along the wide road add to the pleasure of the traveller. Numbers of kampongs with thick bamboo hedges lie in the middle of extensive fields, which are very often planted with sugar. Many specimens of *Mangifera indica* L., are found in the kampongs, which in the low land of Pasoeroean and Probolinggo produces exceptionally handsome fruit, famous throughout Java.

Leaving the plane the road winds upwards, gradually the winding becomes shorter and the turns sharper. Careful driving is necessary; near kilometer-stone 20 a wrecked car is fixed on posts as a warning.

On this part of the Tengger foot, where, in complexes of great andesite blocks, the old lava-streams can be recognized here and there, capoc-trees (*Ceiba pentandra* L.), are to be seen with their branches horizontally attached in a few wreaths, also djati (*Tectona grandis* L.f.); as road-side trees *Lannea grandis*, *Cassia siamea* and *Hibiscus* are found again. A little higher up the sono kembang (*Pterocarpus indica* L.) appears close up the damp Poespa at 700 m above sea level. In the flowering time, this tree fills the air with a wonderful scent. At this altitude

the last *Cocos*-palms, and *Musa*-plants are seen. A few kilometres further on, arable land is entirely replaced by forest, which consists only for a small part of original leafforest, but for the most part of coffee-plantations, which are either badly kept or entirely deserted. An important share in this forest complex has *Celtis tetrandra* ROXB., the leaves of which are more or less oblique, triplinerved and long-pointed. Along the road is to be seen the *Impatiens platypetala* LINDL. richly covered with red flowers, while the *Lantana Camara* L. which ran wild on a large scale in a comparatively short time, also brings colour to the various tints of green in this rain-wood. Owing to the sharp winding of the road here, it is not easy to observe certain striking plant-specimens. Amongst these the epiphytical nestfern (*Asplenium Nidus* L.) and the some metres high *Amomum's* (*Zingiberaceae*) in the undergrowth, deserve to be mentioned, and especially the *Pseudodatura arborea* VAN ZIJP superabundantly covered with white large flowers. This shrub, which can be very easily propagated by setting, is to be seen more and more, always with an abundance of flowers. It is continually met with during the rest of the motor-trip, and with the dadap-trees (*Erythrina lithosperma* MIQ.) it brings even as far as Tosari some variety into the uniform, and somewhat depressing looking tjemara-woods (*Casuarina Junghuhniana* MIQ.), which are planted all over the slopes of the mountain ridge, on which Tosari lies, and past which the very steep road twists and turns its way upwards. Besides the dadap practically only the above named *Celtis tetrandra* is found here as leaf-tree. Epiphytes are scarce in the lower lying tjemara forest, but the *Drynaria rigidula* BEDD. which appears fairly frequently makes up for a good deal, owing to its dimensions. This *Drynaria* forms a humus-nest, which goes round the entire stem, and around which the pinnate leaves stand up slantingly in a wreath. In the dry season the pinnae of these leaves fall off, while the leaf-stalks remain

a long time amongst the new foliage. Beard mosses are also found there.

Tosari, nearly 1800 m above sea level, is a very well known health resort. It has only 2/3 of the amount of yearly rainfall of Poespa. Even though it lies in the cloud-zone, and the afternoons there have but a low percentage of sunshine owing to the frequent appearance of mist, the climate, however, with an average temperature of 15.9°, is not chilly. The mist is rather dry, and the relative dampness, which is subject to great fluctuations, is very often considerably under 100%.

The surroundings of Tosari are almost entirely deforested, the inhabitants of this district, which is cut by deep ravines, cultivate all kinds of European vegetables on the fertile soil of volcanic ash. According to JASPER, this cultivation dates from the middle of the 18th century, at which time it was introduced there by the first commanders of Pasoeroean. This vegetable cultivation was enlarged by ADRIAAN VAN RIJCK, who set up a mountain house there, and appointed a European gardener, to furnish the people with seeds and to give them practical help with the cultivation.

No wonder then, that the flora of the immediate surroundings of Tosari has been influenced by this cultivation. Some of the cultivation-plants appear in a more or less wild state, for instance *Rumex obtusifolius* L., *Foeniculum vulgare* MILL., *Tropaeolum majus* L., *Calceolaria gracilis* H.B.K. Amongst those species, which have been imported together with those cultivation plants, the following should probably be counted: the *Poa annua* L., *Galinsoga parviflora* CAV., *Briza minor* L., *Trifolium minus* RELH. The beautifully blooming *Fuchsia coccinea* ARR. is only found in hedges, and is seen in thick rows along the road at places where it has apparently run wild, in such cases it closes up a now deserted field or private ground, for

which purpose formerly this decorative plant was planted. Also the *Pseudodatura arborca* which is so much easier to cultivate, appears to me to require human help in order to grow well and gain ground. This plant is often also planted along narrow wood paths in the tjemara plantations. Representatives of plant families which are also found in Europe, make us fancy that we are no longer in the tropics. In connection with this, the following specimens can be mentioned: *Artemisia vulgaris* L., *Polygonum chinense* L., *P. runcinatum* DON., *P. caespitosum* BL., while the *Cuscuta reflexa* R. BR., with uncommonly thick stalks is met with in all kinds of shrubs. Among the more tropical plants the large flowered *Melastoma*-shrubs draw the attention, as do the shrubs of *Lespedeza cystisoides* MAX, with its dark violet papilionaceous flowers growing together in small axillary clusters, the white pilose *Gnaphalium longifolium* BL., a composite nearly related to the Edelweiss; the *Elsholtzia pubescens* BENTH. (Labiatae), shining with an abundance of quadrangular erect spikes, and the white pilose *Buddleia asiatica* L., with purple flowers. The *Parochetus communis* HAM., a creeping leguminose with Oxalis-like leaves, must not be forgotten from this enumeration.

At places where an occasional leaf-tree is still to be found, it seems to be a specimen of the *Engelhardtia spicata* BL. (Juglandaceae), which may be easily recognized by its pinnate leaves. In forest-remains, met with in a few small ravines, KOORDERS saw more representatives of the ordinary mixed mountain forest, such as *Podocarpus imbricata* BI., some Lauraceae, *Quercus pruinosa* BL., *Ficus* sp., *Helicia*, *Manglietia glauca* BL., *Glochidion*, *Macaranga*, *Daphniphyllum*, *Turpinia pomifera* DC. and *Elaeocarpus*.

Owing to the deforesting round Tosari one may enjoy the splendid views down over the Tengger-foot and the plane of Pasoeroean down to the Madoera Straits, upwards over the

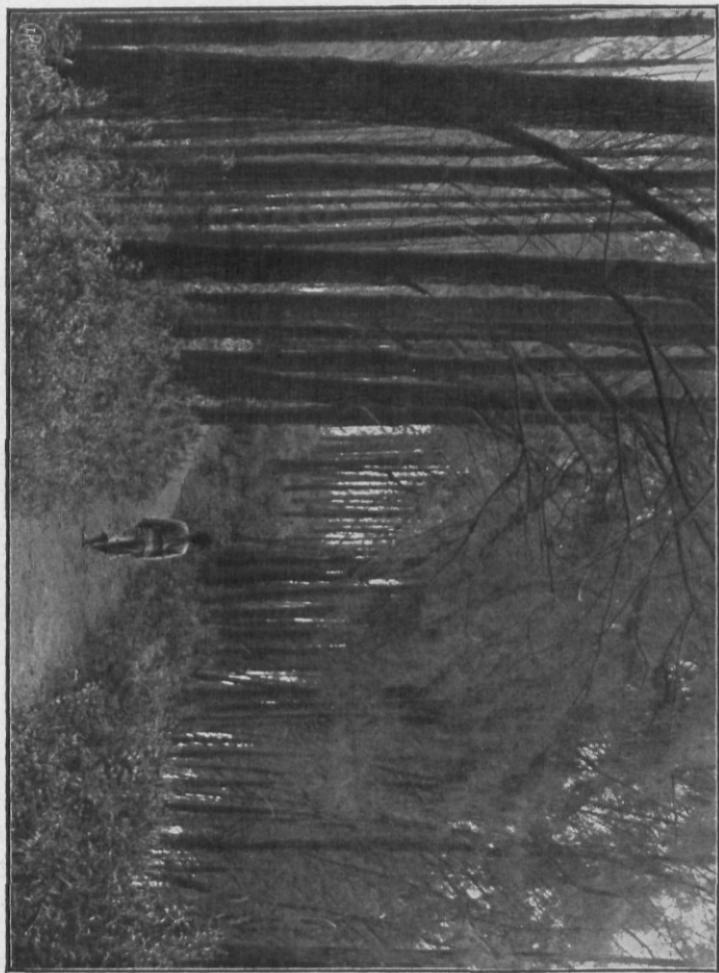
numerous mountain ridges and ravines, which are bounded on the top side by the tjemara-woods.

The trip to the great caldera of the Tengger, — the Sandsea with the secondary eruption points, of which the Bromo only is still active, and ejects ash and stones at irregular periods, — leads upwards, first through the country cultivated by the native inhabitants, where from time to time splendid views are to be seen, then further on along, and finally through the uniform tjemara forest. The forest consists almost entirely of *Casuarina Junghuhniana* Miq. (fig. 1), between which an occasional specimen of *Dodonaea viscosa* Jacq. appears, in a pilose variety. The glabrous one only can be found near the coast of several islands in the Malay Archipelago. This genus just as *Casuarina* has developed mostly in Australia.

This tjemara-forest which is even more uniform of composition than the djatiwoods of the hot low plane, possesses also a more limited diversity in the undergrowth. The ground is often covered by tall herbs and grasses, and only at places where the water supply is more favourable, as in ravines, low bushes and shrubs appear in the midst of more varied herb vegetation. Along the roadside a great number of *Artemisia vulgaris* is to be found, amongst which a few scattered *Bidens* appear, with white radial-flowers, and also *Hypericum Leschenaultii* Choisy, with large yellow flowers. In the forest itself more or less extended areas are often found principally covered by the turf-forming prostrate *Polygonum caespitosum* Bl., above which scattered specimens of *Pteris Wallichiana* AGARDH. are rising up to 2 m. This latter plant slightly resembles a small tree-fern, because of its tripartite decom-pound leaf supported by a powerful stem. In small ravines *Urtica grandidentata* Miq. grows, which is covered with sharply stinging bristles.

Fig. 1. Tjemara-forest on the Tengger mountains.

(Photo by S. Satake, Tosari Studio.)



On the road, European street grass (*Poa annua* L.) is to be found, while on the roadside the decorative plumes of *Briza minor* L. appear. The specimens of *Solanum nigrum* L. and *Pteridium aquilinum* O.K. also give a European aspect to the country. Where the highest point is reached the undergrowth is very rich, suggesting that the water supply there is more favourable. This is only possible, if there is more rain or a more regular rainfall, therefore it might be explained



Fig. 2. *Thalictrum javanicum* Bl.

by the condensing of the mist along the needle-shaped twigs of the tjemara, to which fact BRAAK has several times drawn the attention. This condensing also occurs elsewhere, but there is probably more chance of greater condensation here, as the rising or falling of the air streams at this rather level place is stopped. Among the shrubs are found *Debregeasia longifolia* WEDD. with pointed narrow leaves, white underneath; the entirely white or yellowish pilose *Gnaphalium longifolium* Bl., and the likewise strongly pilose *Buddleia asiatica* L., and the *Elsholtzia pubescens* BENTH., all three

also having narrow leaves. Many grasses grow luxuriously here, some of which have only a scarce distribution over Java, for instance *Avena Junghuhnii* BUESE, *Koordersiochloa javanica* MERR., *Microlaena stipoides* R. BR., amongst which the decorative foliage of *Thalictrum javanicum* BL. (fig. 2) is found, and also the characteristic *Rubus niveus* THUNB., whose leaves are white pilose underneath. Large and small groups of *Euphorbia Rothiana* SPR. which is much seen on the Tengger, are found there, and the large specimens of *Foeniculum vulgare*, which has run wild here. The aspect of the flora is further revived by *Pimpinella javana* an Umbellifera with cordate leaves, *Plectranthus javanica* BENTH. (Labiatae) with little flowers in terminal panicles; *Cynoglossum javanicum* THUNB. with Myosotis-flowers; *Dichrocephala* with green and yellowish globose heads, consisting of tubular florets only.

Contrary to the rain-wood with its well-known abundance of climbing plants and lianes these plant forms are almost entirely lacking in the tjemara-wood. Epiphytes are also not to be found in the fairly young wood.

On the East side of the ridge is a plantation of *Dodonaea viscosa*, in which the undergrowth has already sprung up in great abundance, *Albizia montana* BENTH. is to be seen in dried off examples, on which knot-shaped thickenings, caused by a mould (*Uromycladium Tepperianum*), can still be quite clearly distinguished on several branches. Where the road is dug out in the tuff layers, *Gnaphalium longifolium* grows against the steep banks, and also a few scattered specimens of *Sonchus javanicus* with large yellow flowers, *Buddleia*, against which the dark green *Anaphalis viscida* stand out sharply, a few of which appear at the top ridge of such a bank. It has rolled up needle-shaped leaves. This *Anaphalis* is quite a common sight on sunny grass-slopes in the upper Tengger regions (fig. 3). A creeping Umbellifera (*Hydrocotyle sibthorpioides* LAM.) also

grows on those banks, further upwards the *Wahlenbergia marginata* DC. and *Equisetum debile* ROXB. are to be found everywhere, and here and there the volcano-fern: *Pleopeltis Feei* v.A.v.R.

Along this road leading to a flat valley, specimens are again repeatedly seen of the plant species mentioned above for the tjemara-wood. The *Pseudodatura* is also to be found again here and there, very many are even found amongst a group



Fig. 3. *Anaphalis viscida* DC. on the S.W. slopes of the Ider-ider.

of old *Casuarina* trees, in a damp low lying piece of ground, where handsome specimens of stinging nettles are also found. On these tjemaras is also to be seen a dark brown pilose half-parasite, a species of *Scurrula* (Loranthaceae) which has not yet been described. The amassment of fallen twigs on horizontal parts of the branches carry the very few epiphytes known from the tjemara-wood, amongst which the *Peperomia reflexa* A. DIETR. comes first, but a few orchids are also



Fig. 4. View from the top of the Panandjaän on Dasar, Batok, Bromo, Smeroe and Tjemara Lawang.
(Photo by S. Satake, Tosari Studio).

found at these places (KOORDERS, for instance, collected *Dendrobium tenellum* LINDL. and *Dendrobium Hasseltii* LINDL.).

The country as far as the Moengal-pass is now only slightly hilly; one passes through woods of young tjemara and kem-landingan goenoeng not yet closed off, in which many climbing plants are to be found. The flat road is covered there by grass (*Imperata cylindrica* BEAUV., and *Cynodon Dactylon* L.). Further on, the greatest part of the country is covered by the sappy green of *Albizzia montana*, which, at places where forest fires have occurred, can gain ground better than the tjemara, as they grow out again very quickly, after being burnt down to the ground.

Along the road there are again some steep banks, on which groups of *Vaccinium variegifolium* MIQ., are often to be seen, under whose protection and shadow evidently only the already mentioned *Pleopeltis* will grow. This combination is very general on the Tengger. Where *Vaccinium* appears one may also expect to find *Pleopeltis*.

As one of the striking species of the characteristic mountain plants which are found scattered here, the *Valeriana Hardwickii* WALL. and the *Astilbe indica* BL. may be mentioned, both of which, like so many kinds of this group, have a distribution from Burma over the high mountain tops of Sumatra, to those of Java, and of which some appear still more eastwards on the row of high volcano tops of Bali, Lombok, Flores and South Celebes.

From the Moengal-pass an impressing view of the caldera of the Tengger mountain-mass may be seen in fine weather; this view however comes second to the one seen from the higher and more eastward lying Penandjaän. (fig. 4).

The visible part of the Dasar or Sandsea is only partly covered with grasses, herbs and low bushes; beyond which the north westerly wall of the Widodaren with a great many

ravines can be seen, to the left of which the regularly grooved, truncated, cone-shaped Batok rises, behind which the smoke columns of the Bromo are mounting. To the left the plane is bounded by the steep caldera walls, which are partly covered with more or less dense tjemara woods, and partly with grass vegetation (*Imperata*, *Andropogon parviflorus* BACK.). There is a low part in the wall towards the north east called the Tjemara lawang; the beginning of the great crater crevice of Soekapoera.

Except for a narrow part, the Roedjak, which differs both in aspect and vegetation, and which is situated between the Widodaren and the Ider-ider, which bounds the caldera in the S.W., the Dasar is a large plane, filled up with ash and stones from the secondary eruption-points, of which since historical time, the Bromo was the only one periodically active, even up to the present day.

There are no data at my disposal with which to describe the climate of the Sandsea, but in analogy to that which we learn from the much more full data about the Idjen Plateau, we may assume that the rainfall there is considerably less than on the outside slopes of the mountain-mass. But still it seems strange that this plane, surrounded by high mountain ridges and having no surface eduction for water, is not a lake, and that it is only temporally covered here and there (in the S.E. and N.E. corner) with a little water (JUNGHUHN). It is then to be presumed that the superfluous water is educted underground. Over the greatest part of the Dasar the top layer of the ground soon becomes dry again, and then the fine sand is transferred by the wind. On places therefore where there is no vegetation small dunes are formed. In the dry season dust clouds caused by small local whirlwinds, are sometimes very disagreeable for the traveller.

The vegetation of the Sandsea will not be so scarce because of the influence of the climate and the soil only, but also

because of the influence of the eruptions of the Bromo, several of which caused the occurrence of ash-rains even on the outside slopes of the Tengger. The most forcible eruptions took place in 1804, 1829, 1842 and 1893, ash-rains have also been notified (see JUNGHUHN, and the volumes of the Natuurkundig Tijdschrift voor Ned. Indië) in the years 1815—1825, 1858, 1860, 1896, 1906—1910, 1915, 1916, 1921—1922, while since then moisture clouds rise rather continually. These periods of increased action were alternated by such periods of rest, that the crater-pipe of the Bromo was filled for a greater or smaller part with water (KEMMERLING). It may be accepted, that much new material (including stones and bombs) has fallen down into the Dasar, not only during eruptions such as that of 1829, in which year the branches of the trees on the Tengger broke down under the fall of ash, of which fell even on the S.W. slope a layer up to 20 cm thick, but also during less important eruptions. Each time the vegetation will be partly destroyed. The Batok vegetation will also sometimes be damaged. In accordance with this, are the differences in the descriptions of the vegetation by the various travellers, even though they are but roughly stated. Interruption in the development of the vegetation will have occurred, owing to fires in the dry season.

REINWARDT, who made an expedition to the Bromo in 1821, just during the period of increased action, recorded nothing with regard to any vegetation in the Dasar, but the Batok evidently showed an occasional tjemara-tree. DOMIN, who visited the Sandsea soon after the great eruption of 1829, only mentioned a few small grass plants, which he saw there from time to time. Even in 1838, during his first visit to the Tengger mountain-mass JUNGHUHN finds the sand plane bare, in which the fine sand was whirled up into dust clouds, while the Batok was only covered to half way up, at the foot with occasional *Casuarinas*, with *Pteridium aquilinum*

and young *Albizzia* bushes higher up. In 1844, however, he saw a covering of forest-grass specimens and Cyperaceae on the damp low spots only, while the rest was still a plane of yellow-grey much moving sand. The eruption of 1842 had, however, exercised little or no influence on the vegetation of the Batok, which in November 1844 during JUNGHUHN's second visit, was covered with woods almost reaching to the top. In 1848 BLEEKER's record mentioned a few scattered grasses which with difficulty managed to remain standing in the rapidly drying, much moving sand. The Batok entirely vegetated by *Casuarina* formed a great contrast here. BLEEKER ascribed a considerable age to these trees but was evidently wrong. Six years later TEYSMANN visited the Tengger on his way to the East of Java and Bali, and found in the Sandsea very little vegetation very poorly developed (*Imperata*, and other Gramineae, *Plantago*, *Artemisia* and other Compositae, *Polygonum plebeium*). The Batok is entirely covered, but still he calls the vegetation scarce, the woods thin, which were met with by JUNGHUHN in 1844 having evidently very much degenerated. STÖHR describes the Dasar as being entirely without vegetation, although in a note of his he gives a list of plants which were met with there by ZOLLINGER in 1856 (*Imperata*, *Festuca*, *Artemisia*, *Erechthites*, *Cynoglossum*, *Polygonum chinense*, *Hypericum*, *Styphelia*, *Pleopeltis Feei*). According to him the Batok was at that time, for the most part vegetated by bushes and tjemaras, but also bare sand slopes were to be found.

Fourty years later KOORDERS made a collection of plants from various points of the Tengger mountain-mass. From the Sandsea, he mentioned several plants, which will not be met with on the way from the Moengal-pass to the Bromo; he found these only in the low lying more damp, and more stable S.E. part, with its rich, fairly thick, vegetation: *Rumex crispus* L., *Hypericum Leschenaultii* CHOISY, *Hypoxis aurea*

LOUR., *Oxalis corniculata* L., *Viola inconspicua* Bl., *Pimpinella javana* DC., *Sonchus oleraceus* L. *Briza minor* L.

In 1905 ERNST found the Dasar almost entirely without vegetation, but he saw a tree-less vegetation of grasses and Cyperaceae near the foot of the slopes of crater-wall and eruption cones.

In June 1928 the Dasar seemed to me to have, for a great part, a broken up vegetation, of which the *Festuca nubigena*

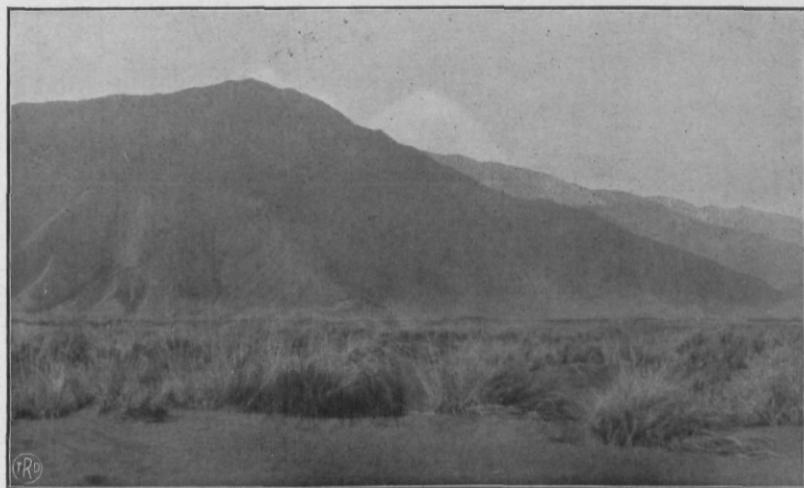


Fig. 5. Dasar with tussocks of *Festuca nubigena* JUNGH.

JUNGHUHN growing in grey-green tufts (fig. 5) forms a very considerable part, while other grasses such as *Imperata*, *Sporobolus Berteroanus* HITCHC. & CHASE, *Calamagrostis australis* BUESE, belong to the most common plants, as does the *Carex baccans* NEES, which often forms the middle of a miniature-dune. Along the foot of the Goenoeng Moengal (fig. 6) the long and narrow strips of *Artemisia vulgaris* draw the attention, in which region *Pteridium aquilinum* also grows. On the sandy slopes at the foot of the Moengal road the interesting *Styphelia*

pungens KOORD., grows, the only representative in Java of the Australian family of the Epacridaceae. JUNGHUHN was the first to discover this plant on the Tengger mountain-mass, which since then has only been found on a few of the other high mountains of East Java. KOORDERS found it on the Tengger mountain-mass along the road from the Tjemaralawang to the Dasar, and at the foot of the G. Moengal. I



Fig. 6. Mount Moengal.
Along the border of the Dasar *Artemisia vulgaris*.

saw them in much greater numbers on the S.W. and S. caldera-rim on the driest places, where the sand was the most moveable; it grew there in small compact groups, next to which *Festuca nubigena* also appeared in numerous tufts, together with *Pteridium*. A little further in the sand plane, a few specimens of the lower, turf-forming *Polygonum plebeium* are to be found, which has an even more limited distribution in Java than the *Styphelia*, but appears again in Australia. Bare

sand planes are to be seen in the corner between Batok and Widodaren whose steep slopes only have a sparse grass vegetation, amongst which small groups of only small *Albizzia montana* are visible.

The vegetation of the Batok continued up to the top, but consisted principally of grasses with scattered specimens of *Casuarina* and smaller bushes (i.e. *Albizzia*).

The ash-cone of the Bromo is entirely bare above the foot, but in the freakishly eroded bottom piece where the ridges often have pale pink coloured sand-crusts, specimens of *Vaccinium* are to be seen in the small ravines, again accompanied by the *Pleopeltis Feei*, which, however, also grows against protecting banks; moreover there are growing red-tinted, prostrate specimens of *Polygonum chinense*, specimens of *Pteridium*, *Carex* and even a few small *Casuarinas*.

Mention of this red tint of the sand is to be found by some authors, JUNCHUHN was one of them, who also mentions the thin crusts; STÖHR describes them as „closed by the rain” and KEMMERLING in 1922, found the ash on the little ridges conglomerated into hard crusts of a violet grey colour. This author found something like this on the Merapi and puts the colour down to the result of weathering. These crusts, in which no micro-organisms could be found, are most probably nothing more than amassments of salts dissoluble in water, which from fresh ash have been conveyed downwards by the rain-water, to be deposited again on the surface during dry periods after evaporation of rising water.

On the return journey from Tosari to Soerabaja a short visit is made to Banjoebiroe and to the Lake Grati, both of which are situated in the lowland.

Banjoebiroe „blue water” is a large well of clear, at the deep places distinctly blue water, through which the uneven

bottom of conglomerated rock may be seen. Large fishes (*Barbus*) are to be found in the water, which the natives consider as holy, as also are the grey apes (*Macacus cynomolgus*) who live in the surrounding trees. Amongst these are to be found *Tamarindus indica* L., *Schleichera trijuga* WILLD., *Artocarpus elastica* REINW., *Mangifera*, *Sterculia foetida* L. with digitate leaves, *Eugenia* and *Ficus* species, all trees of the dry lowland region.

On the road to the lake Grati (or Klintoengan) which is not far from there, the following plants are seen indicating a dry climate, *Calotropis gigantea*, *Acacia tomentosa*, *Zizyphus Jujuba* LAM.; while the imported *Pedilanthus* (Euphorbiaceae) is often planted in the hedges.

This lake is of volcanic origin, it lies in one line with the Smeroe, Tengger and Semongkrong, which is less than 100 m high, and is situated at the coast.

In the water along the border of the lake, whole vegetations are to be seen of *Naia fasciculata* N. BR. and *Hydrilla verticillata* PRESL., and more against the bank a vegetation of *Eichhornia crassipes* SOLMS, while along the water narrow strips of *Cannas* grow here and there, as is to be seen more often in the dry East of Java.

On rocky banks an alternation is to be found of groups of red-tinted strong glandular *Jatropha gossypifolia*, of *Hibiscus surattensis* L., *Calotropis gigantea*, and of *Euphorbia Tirucalli*, which is not a native plant of Java, with all kinds of herbs, which in Java are more especially to be found in the dry regions, such as: *Salvia occidentalis* (run wild), *Sida acuta* BURM. F., *Boerhavia*, *Euphorbia hirta* L., *Hyptis suaveolens* POIR., *Anisomeles indica* O.K.

After a short expedition by boat from the Soerabaja harbour, we come to Kamal on the island of Madoera. This island geologically forms the continuation of the chain of hills in Toeban and Soerabaja, and mostly consists of marl- and limestone-ridges, which in the West enclose large planes, which have been cultivated for planting rice. In this region of Madoera with the relatively highest rainfall, the climate is as dry as in the above named parts of Java, where the forest consists principally of *Tectona grandis*, with scattered complexes of bamboo. Only a few trees of *Tectona* are to be seen along the roads, but all kinds of trees are to be found again, which appear in the djati-wood region of the dry countries, such as *Acacia tomentosa*, *Gossampinus heptaphylla*, *Eugenia Cuminii*, *Mangifera indica*, while much *Pandanus tectorius* is planted in the neighbourhood of the kampongs.

At some places along the road from Kamal to Bangkalan, one passes close to the mangrove vegetation. The parts which have been very much cut down are entirely covered with *Avicennia*. Numerous examples of *Pluchea indica* Less., are to be found there, also *Clerodendron inerme*, and a few marshy parts have a close cover of *Xerochloa imberbis*, the nearest relatives of which are to be found in Australia.

Where the ground is a little higher and cannot therefore be irrigated, it is covered with grasses, in which some scattered groups of trees and shrubs appear. The red earth can often be seen through the vegetation.

A little to the east of Bangkalan lies a fairly extensive lake, the lake of Boernih, which is partly surrounded by sawahs, which on the landside are separated from the kampongs by hedges and small tree-groups. These kampongs often possess a hedge of *Bambusa spinosa* Bl. through which it is impossible to penetrate.

In these hedges and groups, a great part of the plants from the Javanese djati-wood region, are to be found again. Various

fruit-trees are to be found along the outskirts of the kampong, intermingled with *Gossampinus*, *Artocarpus elastica* REINW., *Lannea grandis* ENGL., *Macaranga Tanarius* M.A., *Mallotus ricinoides* M.A., *Dysoxylum amoorooides* MIQ.; but in the hedges there is a still greater diversity of plants. In these hedges of: *Zizyphus Oenoplia* MILL., *Flacourtie indica* MERR., *Flueggea virosa* BAILL., *Glycosmis cochinchinensis* LOUR., *Wrightia pubescens* DC., *Bridelia monoica* MERR., *Ficus leucantatoma* POIR., *Streblus asper* LOUR., all kinds of climbing plants are to be found, such as: *Tetracera indica* MERR., *Plumbago zeylanica* L., *Jasminum pubescens* WILLD., *Bridelia stipularis* BL., the twigs of which, loaded with fruit, hang down, *Brucea amarissima* DESV., *Dioscorea alata* L., *Lygodium flexuosum* Sw., *Unona discolor* VAHL, *Uvaria littoralis* BL., *Passiflora foetida* L., while in the shadow of these plants all kinds of small shrubs and bushes grow up, such as: *Ardisia humilis* VAHL, *Microcos tomentosa* SEEM., *Clausena excavata* BURM. F., *Hyptis suavcolens* POIT., *Callicarpa cana* L., amongst which smaller and larger herbs appear such as *Stachytarpheta jamaicensis* VAHL, *Oplismenus Burmanni* BEAUV., *Cyathula prostrata* BL., *Elephantopus scaber* L., *Urena lobata* L., *Leucas zeylanica* R. BR., *Phyllanthus Niruri* L., *Rungia* spec.

On the small sawah dikes, and along the edges of the sawahs another kind of herb-flora is of course found. On the dikes *Aneilema nudiflorum* R. BR., *Fimbristylis acuminata* VAHL, *Ilysanthes*, *Eclipta alba* HASK., and in shallow water *Utricularia flexuosa* VAHL, *Microcarpaea minima* MERR., *Hymenachne indica* BüSE and in slightly deeper water *Nymphaea* and *Lismanthemum indicum* L.

The small flowering herbs of the dikes, are found again on fairly dry lying sawahs which are very sandy here, but still a few others are found in this low herb vegetation, which are less generally distributed (influence of sandy ground?). Nu-

merous are the small plants of *Mitrasacme alsinoides* R. Br., with pure white flowers on slender stems, the small heads with miniature flowers of *Eriocaulon truncatum* HAM., and a small *Xyris*-specimen (*X. pauciflora* WILLD.), which until 1928 was not known in Java, and which outside Java was found occasionally at very widely separated places in the Archipelago. The ordinary, much stronger *Xyris indica* was formerly collected there also.

The small sandy banks which are a little above the level of the lake, bore a few other kinds of herbs, such as *Oldenlandia hispida* BENTH., a Rubiacea with very narrow stiff leaves, *Lindernia angustifolia* WETTST. and some others.

This summary may be sufficient to give some idea of the great number of plant species, which can be found on a considerably small area, in a dry climate.

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