length and one-eighth in thickness; these soon become attenuated, either by the agitation of the water or the coming into contact with something, and are drawn into very long threads of great tenacity; they stick to everything they touch, and from these the animals are called "cotton spinners" by the fishermen. This small bunch is drawn into a large mass of threads, so small that the finest sewing-cotton is not equal to it, and is no doubt one of the means of defence provided for its preservation; for I have seen a crab so completely entangled in it as not to be able to move, and a fish only able to get away after a long struggle. If much irritated they throw out the whole of their intestines; this is invariably the case after being kept in confinement two or three days; and even after they have done so they have lived three days, and their tentacula performed all their offices as if the animal was strong and healthy. They soon decay when dead if left out of the water, and from their peculiar construction it is a difficult matter to preserve or dissect them. To the physiologist they offer a rich treat. I know nothing of this science; I regret it: my object has been to watch their actions and habits, and I fear I have too long occupied your time. I would here just mention that this Holothuria differs from the *Psolus Forbesii* of Mr. Couch, noticed in the second part of his 'Cornish Fauna,' in having *twenty tentacula* instead of *eighteen*, and *the suckers are in rows*, which was not the case in his. I therefore claim it as *new to the British fauna*, which latter circumstance Professor Forbes confirmed at the late meeting of the British Association at York.

The annexed engraving, Plate XIV., represents the "Nigger" of the natural size; fig. 2, the head with the mouth downwards, showing the tentacula spread out.

XXV.—*On the Import of the inferior Paleæ of the Grasses.*

By Hugo von Mohl*.

[With a Plate.]

There are few points in vegetable morphology respecting which so great a difference of views prevails as that relating to the origin of the floral envelopes of the Grasses. To remove this difference of opinion, at least with respect to one of the points in question, it is above all requisite to ascertain with certainty whether the inferior palea takes its origin from the same axis as the superior palea (or, according to Robert Brown's view, the two leaves composing the upper palea), or whether the two result from different axes. In the first case we undoubtedly accede to

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the representation of the inflorescence of grasses which Robert Brown (General Remarks, p. 580) has advanced,—not, it is true, as the only one possible, but as the most probable,—viz. that the two leaves which have cohered to form the superior palea and the inferior palea, notwithstanding the oblique direction of its insertion, form a trimerous verticil and the outer leaf circle of a perigonium, the inner circle of which is constituted by the scales (lodiculæ); but if, on the contrary, it can be proved that the inferior and superior paleæ belong to two distinct axes, it is thus shown that the inferior palea must be considered a bract from whose axis the floral axis takes its origin; a view which has been adopted with various modifications by several authors, and which has been explained in a most lucid manner by Döll (Rhein. Flora, p. 58). The circumstance that a difference of opinion has prevailed on this fundamental point in the morphological consideration of the inflorescence of the *Gramineæ*, undoubtedly proves that the examination of the normal flowers of grasses does not afford sufficiently certain and convincing proofs to decide with positive certainty the question respecting the derivation of the paleæ; it appears, therefore, to be safest in this case, as in so many other morphological questions, to look out for monstrosities from which we may be able to deduce the normal structure; and if I am not very much deceived, the variety *vivipara* of *Poa alpina*, so widely diffused in the Alps, is fully adapted to solve the doubt existing on the above question. I trust, therefore, that a description of this monstrosity, drawn up with reference to the morphological relations of the spicula of grasses, will not be without interest.

In the viviparous spikes of the *Poa alpina* I have found the two calycine valves (Pl. XIII. B, fig. 1 to 4 *c c*) always perfectly normal, and only the paleæ deformed; the deviation from the normal structure is generally less in the most inferior flower than in the succeeding one, so that frequently the lowest is still perfectly normal (fig. 2), or approaches more to the normal structure than the flower situated higher up (fig. 4).

The axis of the spicula exhibits the least variations. It is, as far as it bears abnormal flowers, more or less thickened, full of sap, presents an unlimited growth superiorly, and frequently small rootlets shoot out from its inferior internodes; in short, it has assumed the characters of an axis of vegetation, and perfectly resembles with its leaves a small culm of grass (Pl. XIII. fig. 1); while its inferior portion, which bears the calycine valves and forms the petiole of the spicula, is of the same small diameter as in the normal spicula, and, like the fruit-bearing spicula, dries up after the flowering season, which admits of the falling off and independent vegetation of the upper deformed portion.

In the monstrous flowers the inferior palea presents an increase

in size, and a more or less perfect metamorphosis into the form of a vegetative leaf. Generally, and especially upwards from the second flower, this metamorphosis into a leaf provided with sheath, ligula and lamina is perfect (fig. 4 *p''*, fig. 5 *p''*); while even when the lowermost flower is partially abnormal, its inferior palea (fig. 4 *p'*, fig. 5 *p'*) frequently forms an intermediate stage between the normal form and that of a vegetative leaf. The latter cases are naturally best suited for allowing us to obtain an insight into the manner in which the metamorphosis of the palea into the vegetative leaf takes place. It is seen by the comparison of several such intermediate stages that the normal palea does not solely correspond, as we might at first be inclined to admit, to the sheath of the vegetative leaf, and that the metamorphosis of the palea into a leaf does not consist in a budding forth of the lamina from the apex of the palea, but that a separation of the various parts of the palea, which are intimately fused together, takes place, and a dismemberment of them one from the other results. The normal palea possesses five nerves, of which the central one extends to the apex of the palea, while the lateral nerves are lost within the transparent scarious membrane. On its metamorphosis into a leaf the palea becomes elongated; its inferior portion surrounds the superiorly-situated portion of the spicula in the form of a vagina, while its upper portion bends more or less outwards and becomes changed into the lamina of the leaf (Pl. XIII. B, fig. 1, fig. 2 to 5 *p''*). In those paleæ in which this metamorphosis is merely indicated, the palea still retains nearly its proper form and the reddish colour which is diffused over the normal palea, and it is only its apex which has become thicker, of a greenish colour, uncinate and recurved superiorly (fig. 4 *p'*, fig. 5 *p'*): a separation into vagina, ligula and lamina is not yet indicated. When the metamorphosis has advanced further, the whole palea is lengthened considerably, its upper portion has become thicker, green and leaf-like, while the lower portion has retained its more delicate texture, transparency, and likewise frequently the reddish colouring; the nerves, which are still present to the number of five, have acquired a more parallel position in consequence of the elongation of the leaf, and become confluent towards the uncinately-curved apex of the latter. The margin is scarious as in the normal paleæ. The separation into the various parts of the vegetative leaf now begins, and is terminated by the development of the ligula and the transverse separation between the upper green and the lower brighter-coloured parts of the palea.

The formation of ligula frequently occurs only at one part of the leaf, in its central line, or on one of the lateral halves, or on a part of one of these, while in the other portion lamina and vagina

still pass immediately into each other (fig. 6—8). The ligula is formed by the elevation of a transparent scale on the upper surface of the leaf in a transverse or somewhat oblique direction. Very frequently it is developed only on the central portion of the leaf, and has then usually a crescent shape (fig. 7); in other cases this incipient ligula is only met with on one of the sides of the leaf (figs. 6, 8); very frequently it does not extend to the margin of the leaf, and every trace of its auricle is still wanting (figs. 7, 8); in other cases the auricle is developed without the central portion of the ligula being present. The development of the auricle takes place in the following manner: the scarious margin of the leaflet, which extends at a less advanced stage of transformation to its apex, retracts itself as it were from above downwards, and instead of gradually becoming acute and disappearing in the green-coloured margin of the leaf (fig. 6), now projects in the form of a rounded prominence on the margin of the leaflet, and passes into a scale projecting on the upper surface of the leaflet (fig. 6 *a*). In this manner the ligula appears, not as a part foreign to the leaf and adnate with it, but as an exuberant growth from it like the corona of the petals of a pink. Simultaneously with the perfect development of the ligula occurs the formation of the node between the vagina and lamina, and thereby a distinct separation of the two parts of the leaf.

Far more important is the consideration of the base of the metamorphosed paleæ, as regards the question which principally occupies our attention. While the base of the normal palea always surrounds only a portion of the axis, and consequently leaves it doubtful whether the palea is the product of the primary axis of the gramineous flower, or whether it forms a verticil with the two leaves composing the superior palea, not the least doubt can exist respecting this point in the metamorphosed palea; for not only does its base surround the stem entirely, but both its margins cohere towards its lower extremity (fig. 5 *p'*). Now it is perfectly evident in this case, that the axis which is surrounded by the leaflet, and from which this takes its origin, is the primary axis of the spicula, and that the superior palea belongs to the floral axis, situated in the axis of the inferior palea; consequently that the inferior palea must not be considered as a perigonial leaf, but as a bract.

In proportion as the above-described metamorphosis of the palea into a vegetative leaf advances, the flowering organs decrease in size. In the axis of the palea of the lowest flower of a spicula, we generally find the whole of the floral parts in a crippled state; the superior palea is generally still very large in comparison to the other flowering organs, and bifurcate at the apex, but not separated into two distinct leaflets. In the axis of the