LETTERS TO THE EDITORS

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A New Interpretation of the Mechanics of Pulvinar Movement

Knowledge of the mechanics of pulvinar movement is based mainly on the work of Dutrochet[1], Pfeffer[2] and others conducted in the nineteenth century. They showed that if the upper half of the primary pulvinus was removed from the leaf of *Mimosa pudica* then leaf movement continued, although on a reduced scale. It was deduced from this that the lower half of the pulvinus is principally concerned with the movement, which was then accounted for in terms of loss of turgor followed by recovery. This early explanation of pulvinar mechanics is still widely accepted by workers in this field[3], and has recently been used in drawing comparisons between the movement of guard cells and pulvini[4]. The results are briefly reported here of studies on leaf movement exhibited by *Samanea saman* Merrill and *Mimosa pudica*. In our view they cast doubt upon the validity of this explanation.

The above experiment was repeated, in a modified form, upon the secondary pulvinus of the leaf of *Samanea*, which has the same nyctinastic response as the primary pulvinus of *Mimosa*, that is, curving downwards in the evening towards the 'closed' position, and upwards in the early morning towards the 'open' position. During the day, this pulvinus supports the weight of the leaflets, to which it is attached by the rachis. The latter acts as a lever, so that a pressure is exerted upon the lower half of the pulvinus and a pull on the upper half. In the experiment described here the pulvinus was relieved of these forces. This was done by orientating the leaf in such a way that the pinna moved in the horizontal plane, instead of the vertical, and then by suspending the end of the pinna from a freely swinging arm with a fine thread.

Three leaves were set up as above. The first served as a control, and it showed the normal nyctinastic movement, although now in the horizontal plane. At midday the upper half of the pulvinus was removed from the second leaf, and the lower half from the third. Afterwards the second pulvinus curved a little farther in the 'open' direction, where it remained permanently, the nyctinastic movement disappearing completely. The pulvinus of the third leaf commenced to 'close' immediately after the removal of the lower half. When it had attained the fully 'closed' position, no further nyctinastic movement was shown by it also. In each case the remaining half of the pulvinus stayed fully turgid and healthy in appearance throughout the experiment. Identical results were obtained when this experiment was repeated using the primary pulvinus of *Mimosa*. Here the seismonic response also disappeared. This confirmed the work of Bert[5], who reported that movement in *Mimosa* disappeared when the petiole was placed on its side and the upper half of the pulvinus removed. Thus neither the upper nor the lower half of the pulvinus alone is able to bring about leaf movement. This suggests that movement in the complete pulvinus is due to the upper and lower halves alternately expanding and compressing the opposite half.

It was confirmed that a reduced movement occurs in the normally orientated leaves of *Mimosa* and *Samanea* when the upper half of the primary pulvinus of *Mimosa*, or the secondary pulvinus of *Samanea*, is removed. It can now be attributed to the leverage effect already described, which acts upon the lower half of the pulvinus as a compressing force, inducing the cells to lose water, with subsequent contraction in volume. Hence a nyctinastic or seismonic movement can take place under these conditions. Confirmation of this explanation comes from experiments on *Samanea*, in which a small, constant, upwardly directed force was applied continuously to a pulvinus from which the lower half had been removed. Reduced nyctinastic movement then occurred, although such movement is not normally shown by the upper half alone. The occurrence of a nyctinastic rhythm in circumstances where one remaining half of the pulvinus is subject to a constant compressing force suggests that the ability of the cells to withstand compression varies diurnally. In the complete pulvinus it is least among cells of the lower half at the end of the day. Therefore at this time the force exerted by the upper half, together with the leverage effect, is now sufficient to cause the cells of the lower half to lose water. The tissue is then compressed into a smaller volume and, as a result, the pulvinus curves downwards and the leaf 'closes'. In the early morning the reverse occurs, the cells of the lower half regaining their turgor and exerting a compressing force on the cells of the upper half, which in their turn are now least able to withstand compression. They lose water and are compressed so that the pulvinus bends the leaf back into the 'open' or day position.

It is therefore concluded that pulvinar movement is caused by a force resulting from increase in turgor in one half of the pulvinus acting on cells in the other half, which are in a receptive state for compression. In the case of 'closure', this force may be supplemented by the effect of gravity.

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Rhythmic Flight Activity of Certain East African Trichoptera

While studying the cyclical emergence of aquatic insects from Lake Victoria, observations were made on their flight activity throughout the night. Similar investigations[1–4] conducted in temperate regions have been chiefly concerned with terrestrial insects.

In the present study, the number of insects caught in a Robinson-type insect trap[5] fitted with a 125-W. mercury vapour bulb was taken as a measure of flight activity. A receptacle containing alcohol placed inside the mouth of the trap ensured that all incoming insects were killed immediately. This container was changed at 10-min. intervals during 18.00–07.00 hr. East African Standard Time. The trap was situated about 300 metres from the lake-shore on raised ground. Plecoptera, Ephemeroptera, Hemiptera, Trichoptera, Coleoptera and Chironomidae were represented in the