

tip of the wing ; discal transverse vein straight, parted by one-fourth of its length from the border, and by very much more than its length from the præbrachial transverse vein.

12. *SOITA PSILOIDES*. *Mas.* Pallide lutea, tibiis anticis femoribus halteribusque pallide testaceis, alis cinereis apud venas subluridis vena transversa discali fusco nebulosa.

Male. Pale luteous, with black bristles. Femora and fore tibiæ pale testaceous. Wings cinereous, slightly lurid along the veins ; veins black, pale luteous towards the base ; discal transverse vein clouded with brown hindward ; halteres pale testaceous. Length of the body 5 lines ; of the wings 8 lines.

Subfam. HYDROMYZIDES, *Fallén*.

Gen. NOTIPHILA, *Fallén*.

13. *NOTIPHILA ORTALIOIDES*. *Mas.* Nigra, thorace piceo tomentoso, tarsis piceis, alis nigris lituris quatuor interioribus parvis quatuorque exterioribus majoribus transversis albis.

Male. Black. Head and thorax with some black bristles. Eyes bare. Antennæ as long as the face ; third joint linear, much longer than the second ; arista plumose. Thorax with piceous tomentum. Tarsi piceous. Wings black, with eight white marks ; four marks minute, near the base ; four exterior, larger, transverse ; discal transverse vein straight, parted by half its length from the border, and by very much more than its length from the præbrachial transverse vein. Length of the body $1\frac{3}{4}$ line ; of the wings 3 lines.

Facts relative to the Movements of Insects on Dry, Polished,
Vertical Surfaces. By JOHN BLACKWALL, F.L.S.

[Read Nov. 17, 1864.]

(Abstract.)

As objections continue to be urged against the opinion that flies and other insects of various species are enabled to move on the vertical surfaces of highly polished bodies by the emission of an adhesive fluid from the numerous hair-like papillæ distributed over the inferior surface of their pulvilli, the statement of a few plain facts for the consideration of dissentients, and especially of those who still advocate the hypothesis that flies, in such instances as those referred to above, are supported in their movements mainly by the pressure of the atmosphere, may, perhaps, be deemed deserving of attention.

Without the slightest intention to undervalue the importance of microscopic researches into the organization of the parts in question, I may be permitted to remark that the careful observation of phenomena and judiciously selected and skilfully conducted experiments afford equal if not superior advantages with regard to the determination of the function they perform; and that the two methods of investigation should be pursued contemporaneously, and, as far as opportunities will admit, in combination.

Having clearly ascertained by repeated inspections of the pulvilli of flies under the microscope, both in a state of action and repose, that a vacuum cannot possibly be formed between them and smooth surfaces to which they are applied, unless the papillæ with which they are provided separately contribute to produce such an effect, it was immediately perceived that a decisive test of the truth or fallacy of this conjecture might be obtained by means of the air-pump, and the result of its application was to demonstrate, not only that flies can traverse the upright sides and the interior surface of the dome of an exhausted receiver while their physical energy is unimpaired, but also to establish the important fact that individuals occasionally remain fixed to the sides of the glass after they have entirely lost the power of locomotion, a circumstance which admits of only one explanation, namely, that an adhesive fluid is emitted from the extremity of their papillæ. The sole suggestion hitherto advanced, which has even the appearance of at all affecting the validity of the conclusion thus arrived at, is that the specific gravity of flies is so low that a very slight degree of adhesive power is sufficient to sustain them in the position they occupy; but, low as it undoubtedly is, it greatly exceeds that of atmospheric air, and it is evident that the efficiency of the adhesive agency to support them on a polished vertical surface *in vacuo*, thus conceded, must be ample to enable them to move on the glass of our windows in perfect security, under ordinary circumstances, without the adventitious aid of atmospheric pressure; the question of specific gravity, therefore, may be safely eliminated as being of no moment in any attempt to solve this interesting physiological problem.

The argument so much relied upon by opponents is, that if flies retained their position on polished vertical surfaces by means of an adhesive fluid emitted from the hair-like papillæ on the inferior surface of their pulvilli, they would, after remaining long in one situation, be unable to quit it by any muscular effort they

could employ without seriously injuring those delicate parts, in consequence of the tenacity that the fluid would acquire by desiccation; whereas it is well known that their movements are not in the least impeded by this circumstance. Plausible as this reasoning is, it appears to be based on the erroneous supposition that the properties of the fluid resemble those of animal-glue or vegetable-gum, an assumption which is at variance with all the particulars that have been ascertained in connexion with the phenomenon; in fact, the fluid merely assumes a gelatinous consistency on exposure to the atmosphere, and is readily removed from the pulvilli, when redundant, by the customary mode of cleansing those organs employed by insects, which it could not possibly be were it of the tenacity implied by the foregoing conjecture.

That flies are unable to walk on polished vertical surfaces when breathed upon till the aqueous vapour expelled from the lungs is copiously condensed thereon is an acknowledged fact; but it does not appear to be known that when thus treated they cannot even retain the position they occupy, whether they make any visible effort to do so or not, a circumstance that seems to be quite inexplicable on the hypothesis that they are supported by the agency of atmospheric pressure, but which admits of a satisfactory explanation on the principle of a solvent fluid acting upon a gelatinous and moderately adhesive animal secretion; and these remarks apply to numerous species of insects, and also to spiders provided with scopulæ; but the latter, when they perceive their footing to be insecure, frequently attach themselves to the spot by emitting from their spinners a little of the viscid material of which their silken lines are formed that possesses the property of being insoluble in water.

In spring, summer, and autumn house-flies may frequently be seen adhering so firmly to the upright surface of the glass of windows that they are incapable of extricating themselves though they make every exertion to accomplish that object, yet, when breathed upon till the aqueous vapour exhaled is condensed about them, they speedily fall from the spot to which they were previously attached so strongly. Now that this remarkable affection of the house-fly cannot be caused solely by a low state of atmospheric temperature, as it has been surmised, is evident from the circumstance that it often occurs in the hottest period of the year; in the months of July and August 1864, upwards of twenty instances of this curious fact were noticed; it must be ascribed,

therefore, either to feebleness resulting from some other cause, or to an increase in the adhesiveness of the fluid secretion emitted from the papillæ in the act of climbing. If it should still be insisted upon that the phenomenon is the result of atmospheric pressure, it behoves the advocates of that hypothesis to explain in what manner a little condensed vapour causes the liberation of insects that are unable to accomplish the act by their own unaided efforts. That an organ deemed to be capable of so entirely expelling the air from the space between its extremity and smooth surfaces with which it is brought in contact as to produce a vacuum, should yet be incompetent to effect the exclusion of so dense a fluid as water, does certainly appear to be in the highest degree improbable*.

The promptness and celerity of the movements of flies in an inverted position, or with their backs downwards, on highly polished surfaces, and the certainty with which their hold is immediately secured when they alight upon them, would seem to preclude the possibility of the employment of muscular force on such occasions adequate to the instantaneous expulsion of the air between their delicate climbing apparatus and the plain on which they move, to the extent required for the formation of an efficient vacuum; but every difficulty is at once obviated by admitting that a minute quantity of moderately adhesive fluid, which acquires a gelatinous consistency on exposure to the atmosphere, is emitted from the organs of sustentation. Unexceptionable evidence that such actually is the case has been obtained by observing that the extremity of each papilla becomes cauterized when subjected to the action of finely pulverized nitrate of silver; and that insects, when traversing a vertical surface of glass, leave upon it a visible and enduring trace of their path, for the better perception of which a lens having a high degree of magnifying power should be employed.

Though perfectly satisfied that the conclusion deduced by me from the experiment with the air-pump rests on too secure a basis to be subverted, yet a desire to remove all apparent difficulties which may be thought to militate against the view that I have promulgated of the means by which numerous species of insects and spiders, and even some reptiles, are enabled to move on dry,

* The adhesion of flies to the glass of windows and to other surfaces, towards the end of summer and in autumn, is usually caused by the growth from the interior of the body of a parasitic fungus (*Sporendonema muscæ*, Fries; *Empusa muscæ*, Cohn).—G. B.

polished, vertical surfaces, must serve as my excuse for obtruding once more on the attention of naturalists a subject that has been the occasion of so much controversy.

Further Note on a Skeleton of *Dinornis robustus*, Owen, in the York Museum. By THOMAS ALLIS, Esq., F.L.S.

[Read Nov. 17, 1864.]

IN my paper on the *Dinornis* read before the Society on the 16th of June, I stated that the three dorsal vertebræ immediately above the sacrum were normally anchylosed; when we mounted the skeleton we found that was not the case, and we separated all these vertebræ. It was so long since I had employed myself in comparative osteology, that I had forgotten that to have these bones anchylosed is only the normal condition of birds which possess the power of flight; having discovered the mistake, I feel it a duty to acknowledge and rectify it. We also found that we have the first phalanx of the left middle toe; we thought we wanted every bone of that toe: we further found that all the phalanges of the left outer toe, as well as part of the condyle to which they were articulated, have lost the whole of their periosteum, in consequence of their exposure to atmospheric change and influence from their near approach to the external circumference of the sand-drift in which the bird was entombed. I stated that the only figure of the *Dinornis* to which we had access gave the bird but two sternal ribs. Professor Owen informs me that that had been corrected in vol. iv. (pl. 46) of the 'Zoological Transactions.'

In the report of my former paper I am made to say, "that the middle cervical vertebræ had suffered from exposure above the surface of the ground." What I said, or meant to say, was, that they were so high in the sand-drift as to be within reach of the deleterious influence of the atmosphere; while the other parts of the skeleton were at a sufficient depth to be secured from its influence, with the exception of the left toe before alluded to. Had the vertebræ been above the surface, it would have been impossible for so many detached bones to have been preserved in the regular succession in which we find them; the nine cervical vertebræ we have, are evidently the lowest nine in the series.

In the cavities of the sacrum we found a good deal of impal-



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