

Influence of the sun on the flight direction of some Coleoptera.

By

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With 3 figures.

While dealing with the distribution and the immigration history of the Carabidae of the Baltic isles I was struck by the fact that the dispersal of flying forms has apparently been much more common from the east to the west than in the opposite direction. This was especially astonishing in the case of the Åland-islands because the nearest mainland (Sweden) lies west from the islands and the south-west winds are more or less predominating throughout the year.

This fact would be intelligible if it could be shown that the direction of flight of these insects is not at random but directed by some factor forcing them to fly chiefly toward the west. No other factors than the sun can be expected to have such an influence.

In order to test this hypothesis experimentally I constructed a simple apparatus (fig. 1—2). The lower part is divided in 8 sections, each of which is continued downwards in a funnel. The lower end of each funnel extends in a glass pot. Over the whole lower part, constructed of thin

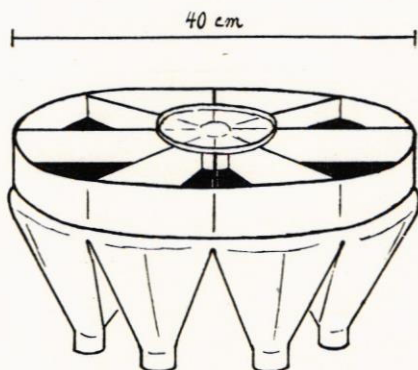


Fig. 1. Bottom part of the flight-direction apparatus.



Photo O. LUNDBLAD.

Fig. 2. Apparatus in use on the «Alvar» of Öland.

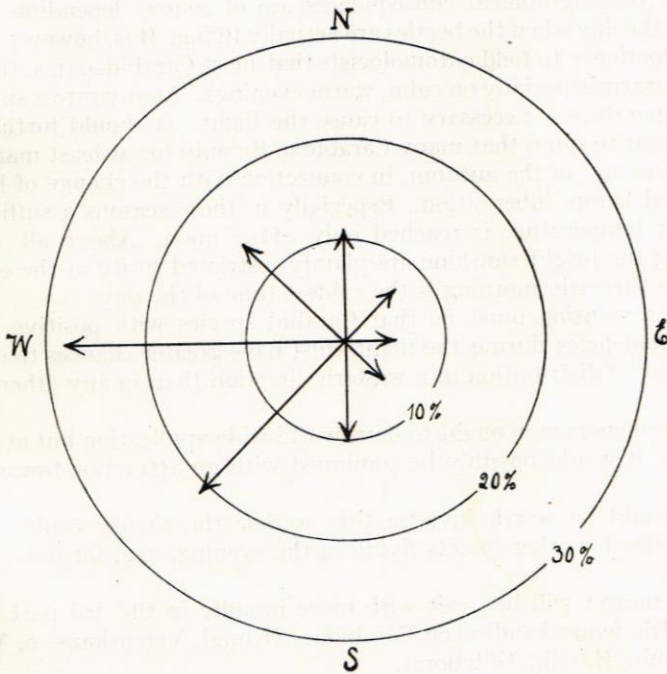


Fig. 3. *Oodes gracilis* Villa. Percentual distribution of 100 indiv. starting in the apparatus between 17 and 19 h at bright sunshine.

sheet-zinc, is placed a dome-shaped cover of transparent celluloid. On the top the celluloid is substituted by loose-meshed cloth in order to make some ventilation possible.

The beetles are placed on a flat bowl in the middle of the apparatus. When taking wings they are clashing against the transparent wall and fall in the glass pot connected with the corresponding section, occasionally in one of the adjacent ones, and are unable to escape. All experiments were carried out between 17 and 19 h, one of the sections being directed exactly westwards.

It was somewhat difficult to find a Carabid with the habit to take wings sufficiently strong to ensure a statistically significant material of observations, but *Oodes gracilis* Villa (from Djursholm, Sweden) proved suitable. The results of 100 cases in which the beetle started to fly in the apparatus are summarized graphically in fig. 3. It seems quite evident that in this species the flight is started prevalingly towards the sun. Experiments with *Acupalpus consputus* Dft. and *A. dorsalis* Fbr. gave similar results.

It is highly improbable that only the direction of the start is phototactically determined, i. e. that a larger apparatus or observations in the nature would reveal flight at random in respect of the direction of light.

The biogeographical consequences are of course depending on the time of the day when the beetles are actually flying. It is, however, a common experience to field entomologists that most Carabidae (i. a. the *Acupalpi*) swarm especially on calm, warm evenings. At any rate a sufficient air temperature is necessary to cause the flight. It should furthermore be brought to mind that many Carabidae fly only (or at least mainly) in the spring and in the autumn, in connection with the change of habitat after and before hibernation. Especially in these seasons a sufficiently high air temperature is reached only after noon. Above all, species avoiding the bright sunshine are plainly restricted to fly in the evening hours as the early morning is the coldest time of the day.

The conclusion must be that Carabid species with positive phototactic tendencies during the flight must have greater chances to enlarge their area of distribution in a western direction than in any other direction.

This phenomenon ought to have world-wide application but at higher latitudes it would possibly be combined with an attraction towards the poles.

It would be worth investigating whether the theory could not be proved also for other insects flying in the evening, e. g. for many Lepidoptera.

The matter will be dealt with more broadly in the 3rd part of my study »Die fennoskandischen Carabidae» (Kungl. Vetenskaps- o. Vitterhets-Samh. Handl., Göteborg).