ARTICULATA 2001 16(1/2): 75 - 78 BIOLOGIE

Induction of song activity in *Oecanthus pellucens* (SCOPOLI, 1763) (Gryllidae, Oecanthinae)

Manfred Alban Pfeifer

Zusammenfassung

Gesangsauslösung beim Weinhähnchen (*Oecanthus pellucens*)
Der Autor gibt Hinweise darauf, dass bei *Oecanthus pellucens* Gesang ausschließlich durch Dunkelheit ausgelöst wird. Die Art scheint nicht eine bestimmte Zeit während der Nacht zu bevorzugen, eine Steuerung der Gesangsaktivität durch eine biologische Uhr ist daher nicht anzunehmen. Gesang beginnt unterhalb einer bestimmten Lichtintensität, welche normalerweise mit dem Dämmerungseinbruch erreicht wird, und endet am nächsten Morgen, sofern Nachts nicht eine Minimaltemperatur unterschritten wird. Die Art singt auch tagsüber, wenn durch starke Bewölkung die Lichtintensität reduziert ist.

Summary

The author gives evidence that song activity in *Oecanthus pellucens* is induced only by a scotophase. Because it has no preference for a certain time during the natural scotophase the species has no need for a biological clock for the regulation of its song activity at all. Song activity is starting just below a certain light intensity - which is normally reached at dusk – and is ending at dawn or when temperature falls at night below a certain threshold. The species may sing during the day when clouds reduce light intensity.

Introduction

Many organisms have an endogenous timekeeper which regulates their activities. In insects this endogenous timekeeper is a so called insect clock. This insect clock mostly follows a circadian rhythm which is calibrated by the alternation of day and night. In Saltatoria the activities in many species follow a circadian rhythm but there are exceptions. For example in *Scistocerca gregaria* no circadian rhythm in locomotion activity was found (ODHIAMBO 1966). As singing in Saltatoria is an essential activity most species have a preferential time for song activity (FISCHER et al. 1996). For example *Metrioptera roeselii* and *M. bicolor* have higher song activities in the first half of a day (FISCHER et al. 1996). But most known is from light trapping in night flying moth the preference of some species for coming at different hours to the light.
Saltatoria, like all insects, are poikilothermal animals and they need a minimum air temperature for song activitity or – in diurnal species – sunshine to raise their body temperature by solar radiation. In *Tettigonia viridissima* was found that the

species prefer singing in warm evenings but is the temperature low the species already sing in the afternoon (NIELSON & DREISIG 1970).

Oecanthus pellucens adult emerge from the end of July to the beginning of August. On warm days males start singing around sunset and song is performed until late night. When temperature remains above a certain threshold (SANDER 1995: 12 °C) the species may continue singing till dawn (Fig. 1).

Methods and results

Field observations

Surprisingly males may even sing during the day. Sander (1995) reports, that in summer, *O. pellucens* starts singing at dusk, but that in autumn the species often starts singing in the afternoon. DETZEL (1998) also observed singing males on cloudy days. Even on a sunny day I located a singing male in thick bushes while individuals in adjacent grassland were not singing. I also found singing males in the early afternoon when sunlight intensity was strongly reduced by thunder clouds.

Observation during the total solar eclipse on the 11th of August 1999 in South-West Germany

I used the rare opportunity of a total solar eclipse for investigating the song activity of *O. pellucens* in the nature reserve 'Monbijou' near Zweibrücken in the South-West of Rhineland-Palatinate. *O. pellucens* began singing soon after 8pm at the day prior to the eclipse (Fig. 1), and continued singing until dawn. The eclipse lasted from 11:10 until 13:54 Central European Summertime, and the period of the total eclipse from 12:30 until 12:32. During this 2 minute period of intense darkening only males were heard singing.

Capture experiments

In my flat in Bobenheim-Roxheim I kept some individuals of the species - which I caught in and around the town - in 1½ l pickled cucumber jars. At night they started singing in the same timescale as individuals in nature. As soon as I switched an artificial light on they stopped. When the artificial light was switched off they started singing again within a few minutes.
In an other experiment I covered the jar with dark woollen sheets so that the crickets were subjected to darkness during the day. Within less than five minutes they started singing.

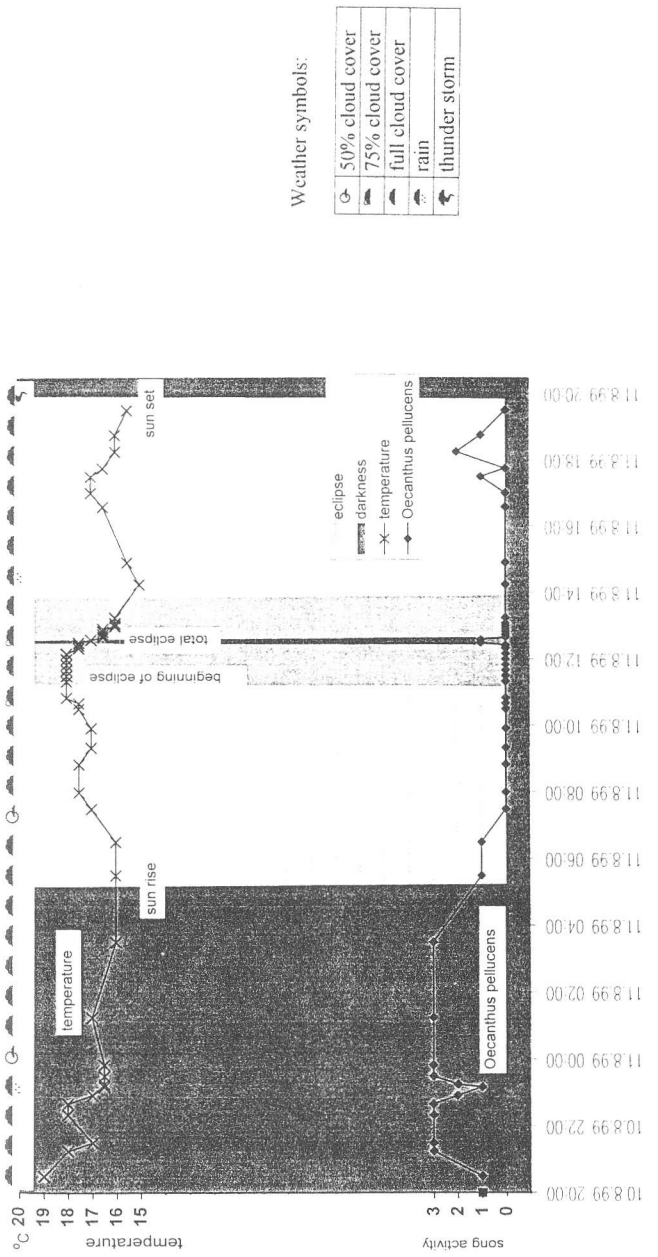

Fig. 1: Influence of light intensity on the song activity of *Oecanthus pellucens* under natural conditions and during the total solar eclipse on 11.8.99 in SW-Germany.
Song activity: 0 = no song activity; 1 = song activity of single males; 2 = song activity of many males, but reduced volume 3 = full song activity of many males, full volume.
Note that periods of rain showers led to cessation or reduction in song activity, especially at the end of the observations on 11Th August.

Discussion

The observations in the field and during the solar eclipse show that *O. pellucens* only sings below a certain level of light intensity. Especially in the capture experiment I could give evidence that song activity is rapidly triggered by diminishing light intensity and is switched off immediately in bright light. The immediate reaction to the exogenous factor light implies that song activity itself is not induced by an endogenous biological clock as it is generally assumed for saltatorian insects (INGRISCH & KOEHLER 1998, p234).
Species which prefer a certain time of day for song activity – such as *Metrioptera bicolor* - may need a biological clock for orientation to the time of day. Also this I call in question because this diurnal active species stopped singing for the span of reduced light intensity during the solar eclipse (PFEIFER in prep.). *O. pellucens* starts singing below a certain light intensity and continues throughout the night until the temperature declines to below a certain threshold or until the beginning of the next photoperiod at dawn. Explanation of this behaviour requires no recourse to a biological clock, but can be explained purely by response to prevailing light intensity.

Author:
Manfred Alban Pfeifer
Anebosstraße 4
D 67240 Bobenheim-Roxheim

References

DETZEL, P. (1998): Die Heuschrecken Baden-Würtembergs. 580 S. (Ulmer), Stuttgart

FISCHER, P.F.; SCHUBERT, H.; FENN, S. & SCHULZ, U. (1996): Diurnal song activity in grassland Orthoptera. - Acta Oecologia 17(5): 345-364.

INGRISCH, S. & KÖHLER, G. (1998): Die Heuschrecken Mitteleuropas. 460 S. (Westarp-Wiss.), Magdeburg;

NIELSON, E. T. & DREISIG, H. (1970): The behavior of stridulation in Orthoptera Ensifera. Behaviour 37: 205-251.

ODHIAMBO, T.R. (1966): The metabolic effects of the corpus allatum hormone in the male desert locust. II. Spontaneous locomotor activity. J. exp. Biol. 45: 51-63.

PFEIFER, M. A. (in prep.): Beobachtungen des Gesangs von Langfühlerschrecken (Ensifera) während der totalen Sonnenfinsternis am 11. August 1999 in der Pfalz – Hinweise auf eine exogene Steuerung des Gesangsverhaltens.

SANDER, U. (1995): Neue Erkenntnisse über Verbreitung und Bestandssituation des Weinhähnchens *Oecanthus pellucens* (SCOPOLI, 1763) (Gryllidae, Oecanthinae) im nördlichen Rheinland-Pfalz und in Nordrhein-Westfalen. – Articulata 1995 10(1): 73-88.