Notes on some field observations on the behaviour of *Leucorrhinia pectoralis* Charp. (Odonata: Libellulidae)

by

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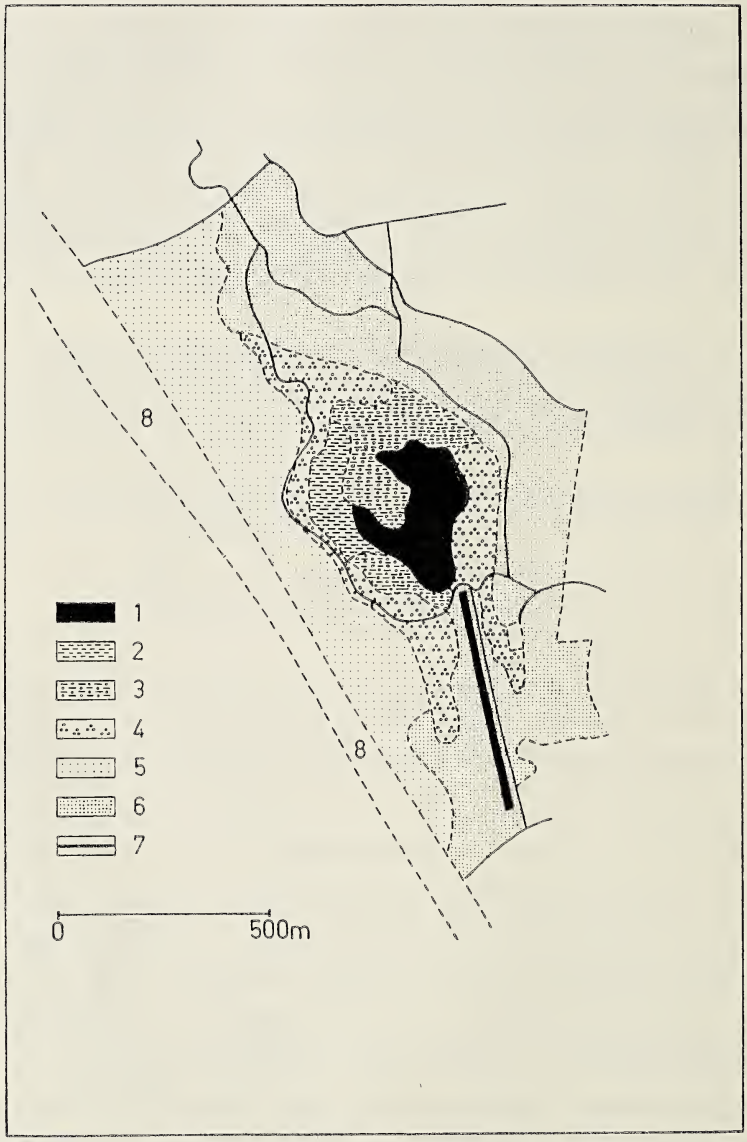

Fig. 1. Topography of the surroundings of lake Quackjes Water. (Interpretation of symbols: 1. water surface, 2. dune-marsh, 3. marsh-scrub, 4. marsh-woodland + dune-scrub + dune-woodland, 5. dune-woodland + dune-scrub + open dunes, 6. open dunes + dune-scrub, 7. paths, 8. beach).

The purpose of this paper is to give a brief account of some field observations on the dragonfly *Leucorrhinia pectoralis* Charp., mainly on its reproductive behaviour. Observations were made in the surroundings of the dune-lake Quackjes Water in Oostvoorne (Zuid Holland prov., Netherlands) during an excursion of the staff of the Dutch State Institute for Nature Conservation Research (R.I.V.O.N.) in June, 1963. The topography of the study area is given in Fig. 1.

The basic method of study was direct observation. Specimens were marked by the cellulose paint method (MOORE, 1960). The population studied was so small that both solitary individuals as well as resting couples could be observed without any optical equipment. Histological examinations were made in the Dutch State Institute for Nature Conservation Research at Bilthoven. Preparations are kept in the collection of the Institute.

Being rather late in the season, no emergance from nymphs or immature individuals was observed.

Leucorrhinia pectoralis is distributed in North-, West- and South-East Europe. In the Netherlands it is rather common, but only locally abundant; the known distribution is shown in Fig. 2.

While the ecology and behaviour of *Leucorrhinia dubia* v. d. Lind. and *L. rubicunda* L. are already well known (PAJUNEN 1962, 1963), the allied species *L. pectoralis* had not yet been studied. Our knowledge of the ecology of the latter species has been briefly summarised by ROBERT (1958). Below we are giving a short outline of some observations while more detailed descriptions will be published elsewhere.

I. HABITAT AND GENERAL FEATURES OF NON-SEXUAL BEHAVIOUR OF MATURE ADULTS

Adult males fly exclusively over and near water, seldom higher than 4 meters above the surface, the usual height being 1—1.5 meters. Exceptionally, a few male individuals were detected in the wood about 200 meters from the water. No solitary males were observed in the dunes.

Generally males are on the wing for no longer than 5 minutes at a time; however, one of the 50 individuals observed was on the wing for 16 minutes. The dragonflies rest on green as well as on dried plants, seldom on sandy paths.

Territories occupied by males are normally confined to a range of 50 meters or less.

Single females are seldom seen in close vicinity of or flying over water, but they are quite frequently observed deeper in the wood. No single female has been seen in the dunes area.

Shortly before heavy rain or a thunderstorm, the insects seek shelter among thick boughs in the nearby wood. They can then be found quite frequently as far as 100—300 meters from the shore. They become insensitive and can be taken without attempting to fly away.

Nocturnal behaviour, as recorded by WESENBERG-LUND (1913), has not been observed.

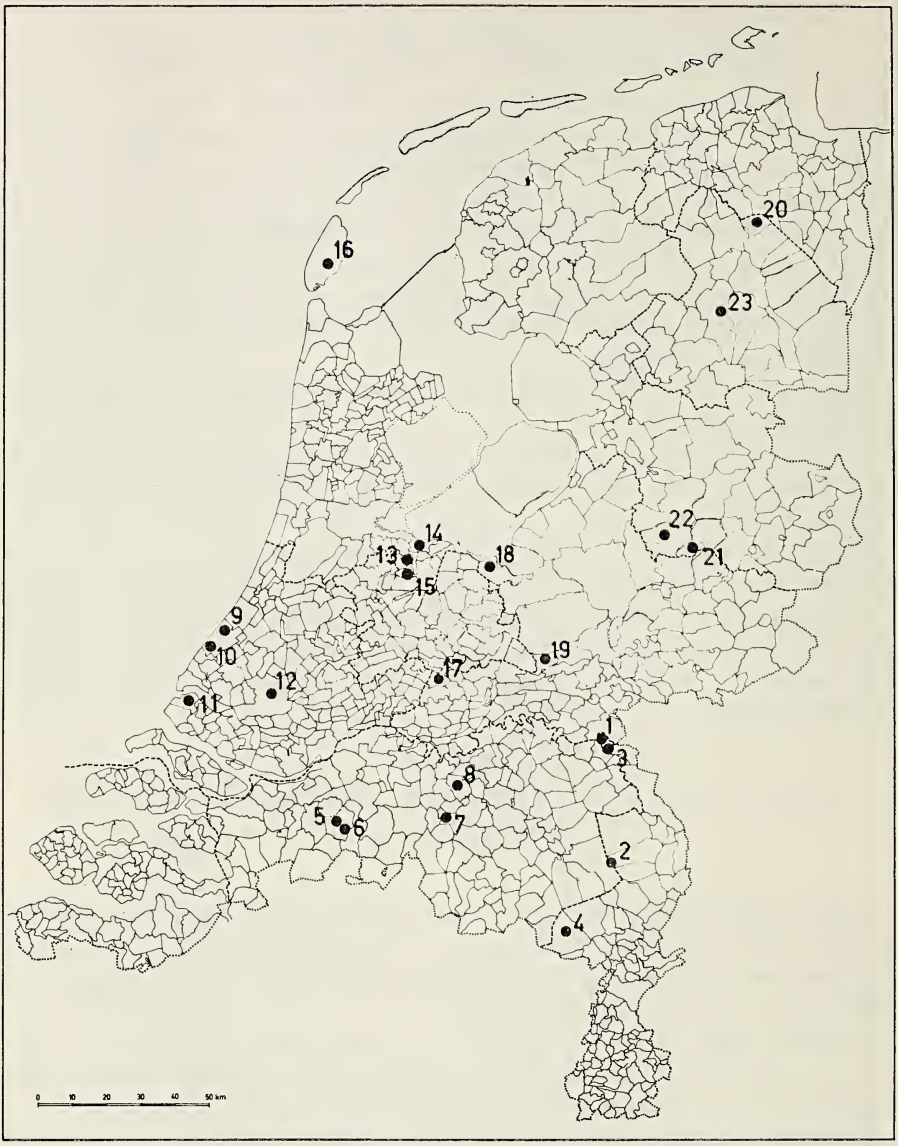

Fig. 2. Known localities of *Leucorrhinia pectoralis* Charp. in the Netherlands. (Names of localities: Limburg prov.: 1. Mook, 2. Peel, 3. Plasmolen, 4. Weert; Noord-Brabant prov.: 5. Breda, 6. Ginneken, 7. Oisterwijk, 2. Peel, 8. Vught; Zuid-Holland prov.: 9. Den Haag (The Hague), 10. Loosduinen, 11. Oostvoorne, 12. Rotterdam; Noord-Holland prov.: 13. Ankeveense plassen, 14. Naardermeer, 15. Kortenhoef, 16. Texel; Gelderland prov.: 17. Culemborg, 18. Nijkerk, 19. Wageningen; Drente prov.: 20. Zuidlaren, 23. Wijster; Overijsel prov.: 21, Bathmen, 22. Colmschate.

II. Sexual Behaviour

Mating always takes place above the surface of or in very close vicinity of the pool. No exceptions to this rule have been observed. After the beginning of copulation the couples always fly some distance from the pool and settle on vegetation. Several times they change their resting places which are never higher than 2 meters above the ground, frequently even in the grass or in low vegetation. When, after a while, returning to the pool, they would leave this again as soon as they are disturbed by attacks from other males or from males of *Libellula quadrimaculata* L. (the latter species was apart from a few freshly emerged individuals of *Orthetrum cancellatum* L., the only representative of anisopterous dragonflies in the area of study at the time of our observations).

Males regularly attack females arriving at the pool. They are attracted by newly arrived females at a distance as great as about 10 meters, provided that the latter fly at a height of about 1 meter. Ovipositing females are not detected by males until they are within a distance of about 2—5 meters. Resting females are detected only from a distance of about 1 meter or less. Males could also be attracted by couples in tandem.

Behaviour towards other species of the genus could not be studied as *Leucorrhinia pectoralis* is the only representative of the genus in the study-area.

At the time of our observations the density of *Libellula quadrimaculata* in the study-area was very high. Sexual reactions towards the latter species have been observed several times but differences in size and structure prevented of course successful mating.

A flying female not willing to mate employs two different ways of escape: (1) she flies away from the water area (usually very high above the water surface) or (2) she hides herself among the shore vegetation. If this is impossible then the female is usually seized by the male's abdominal appendages. When still unreceptive the female seems to be able to prevent the beginning of copulation in tandem position. In such a case the couple will fly for a minute in tandem, after which the male loosens his grip.

When a resting unreceptive female is tempted to mate, she tightens her grip in order to prevent the male to draw her into flight.

Dropping and immobilisation reaction recorded for *L. dubia* and *L. rubicunda* (Pajunen, 1963) has not been observed.

After a female has been seized, she becomes very passive. She does not attempt to liberate herself, follows the direction of the male flight and when resting she does not try to grip the support. Mittelstaed (1950) suggested the possibility that the grip of the male's abdominal appendages disturbs a normal function of receptors in the head and in the prothorax which inhibits normal activity.

In order to study transference of sperm, nine males were dissected and the contents of the copulatory organs examined. The following material was used for the examination: two specimens flying over water in non-sexual activity, two insects taken at the moment of tandem-formation prior to copulation, three in copulation and two taken from their retreats among boughs when hanging there during rainfall. No difference in sperm contents of the vesicula seminalis could be found. This confirms Pajunen's suggestion (1963) that in *Leucorrhinia*

sperm transference is not connected with copulation. The time when it occurs is difficult to guess. According to PAJUNEN it could probably occur before arriving at the water area, probably soon after sexual maturity of the gonads has been reached.

Undisturbed copulation was observed to take 15—25 minutes. Separation occurs when the couple are resting on shore vegetation near the pool.

After copulation the female either oviposits at once or she leaves the pool in order to avoid attention from other males. In such a case she returns when males are less active and their density in the water area is lower. Oviposition in twilight was observed several times, especially in clouded weather.

If a female is going to oviposit immediately after copulation, she is protected by a male who flies above her in order to ward off other approaching males as well as individuals of *Libellula quadrimaculata*. If a female oviposits alone, without male protection, she seeks hidden places among or under thick shore vegetation where males do not follow her.

As can be seen from the above, the differences in behaviour between *L. pectoralis* and *L. dubia* and *L. rubicunda* (PAJUNEN 1962, 1963) are very small. From the point of view of behaviour the genus *Leucorrhinia*, as far as we know, seems to be very uniform.

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Catephia alchymista Schiff. in 1963 (Lep., Noct.). Hoewel ik de eikebomen op de bekende vindplaatsen te Linne en Echt (Sint Joost,, Heingen, Pey en Slek) door omstandigheden niet geregeld kon controleren, heb ik de indruk, dat deze soort weer zeldzamer geworden is: in totaal hier slechts 10 exemplaren gezien in 1963.

In 1962 werden te Belfeld nog slechts enkele exemplaren gevonden, in 1963 werd hier niet één exemplaar meer waargenomen!

A. W. P. MAASSEN, Montfort (L.).

Selenia lunaria Schiff. (Lep., Geometridae). In 1963 had ik een klein ei-kweekje van deze soort, afkomstig van een gevangen ♀. De rupsjes werden ingebonden op wilde roos en inlandse eik. Half juli werd de kweek binnenshuis voortgezet; er waren toen reeds poppen, maar ook nog vrij kleine rupsen. Doch uiteindelijk leverden alle rupsen (op één verdroogde pop na) tussen 31 juli en 11 september de vlinder.

A. W. P. MAASSEN, Montfort (L.).