

PROCEEDINGS OF THE
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ORDINARY MEETING

WEDNESDAY, 7th APRIL, 1965. at 5.30 p.m. (Tea 5 p.m.)

AGENDA

1. Confirmation of the Proceedings of the Ordinary Meeting held on 17th February, 1965.
2. Announcement of Vice-Presidents for 1965.
3. Recommendation of candidates for Fellowship. First reading.
4. Recommendation of candidates for Fellowship. Second reading.
5. Announcement of election of new Fellows.
6. Additions to the Library [see p. 5].
7. Admission of Fellows.
8. Exhibits.
9. Communications.

Mr. W. B. Broughton and Mr. M. D. R. Jones

(*Sir John Cass College, London*)

Some song-tutor experiments and other studies of song modification in bush-crickets
(Orthoptera: Tettigoniidea)

[ABSTRACT]

Regen, in his classical experiments, studied reactions of crickets to their own specific sounds artificialized by transmission through the telephone; and of the bush-cricket, *Pholidoptera aptera* (Fab.), to purely artificial sounds. The former was a locomotory reaction (*phonotaxis*, Busnel), the latter a phonic reaction (*phonoresponse*, Busnel); neither was reported as involving song modification.

Busnel's school studied interactions between species of *Ephippiger* Berthold, and found some degree of modification in that the insects in one way or another fitted whole chirps into each other's intervals—a milder degree of modification than that claimed much earlier by Pierce, who had reported *Pterophylla camellifolia* (Fab.) reacting to sequences of 1 to 5 shouts by sequences of equivalent numbers of chirps (a claim here regarded with reserve until Alexander's recent account of successful confirmation).

Meanwhile, however, Jones began to study the reactions of *Pholidoptera griseoptera* (Degeer) to other males of their own and other species, and to diverse artificial signals; Broughton extended these studies to other tettigonioids.

Most of these phenomena (except the Pierce type) seem susceptible of primary physiological explanations in terms of straightforward inhibition and excitation. Beyond this, stimulus satiation at most might conceivably need to be invoked, but scarcely habituation; still less, the more advanced types of learning.

In this connection, Marler has commented on the lack of studies of song development in insects: Broughton looked at this in a preliminary way in 1964, and found in certain cases unexpectedly sophisticated interactions, which are difficult to explain in simple physiological terms, and which perhaps approach a step or two towards the Pierce type of reaction, though with stimuli nearer those natural to the animals themselves.

Since bush-crickets are believed to have no opportunity of learning from their parents, it was at first difficult to see positive selective advantage in any song-learning phenomenon, which is why the present results were the reverse of expectation. In perennating crickets, the limitation does not apply, and W. J. Bailey of this Department has, through Busnel's kind cooperation, been exploring this aspect in France, continuing now in this country.

The work will be fully illustrated by sound recordings.

NOTICES

The next meeting will be held on *Wednesday, 5th May, 1965.*

Professor T. Eisner.—Defensive glands of Arthropods.

PROCEEDINGS OF THE ORDINARY MEETING HELD ON 17th FEBRUARY, 1965
 Professor Sir Vincent B. WIGGLESWORTH, C.B.E., F.R.S., President, in the Chair
 Present, 64 Fellows and 18 Visitors

The minutes of the Ordinary Meeting held on 20th January, 1965, were confirmed and signed by the President.

The names of the following candidates for election were read for the first time: Dr. Muhammad Akhtar Alikhan, M.Sc., Ph.D.; Mr. Rajindar Kumar Anand; Mr. Robert Bagrie Angus; Mr. Ronald Humphrey Charlton; Professor Howell V. Daly, Ph.D.; Dr. Richard M. Fox, M.S., Ph.D.; Dr. Kurt Harz; Mr. Barry Arthur Penney; Mr. Roland George Smith, B.Sc.; Mr. William Frederick Snow, B.Sc.

For the second time (taken as read): Mr. Martin Christopher Birch; Mr. Syed M. Humayun Kabir; Mr. Fadhil Hameed Khattat, B.Sc.; Dr. Rachel Sara Shpan-Gabrielith; Dr. Richard Stanley Soper, B.Sc., M.Sc.; Mr. John Antony Wightman.

The Treasurer read the names of the following newly elected Fellows of the Society: Mr. Arthur Stephen Aiken, P.O. Box 2636, Johannesburg, South Africa; Mr. John Stewart Badmin, 24 Park Avenue, Solihull, Warwickshire; Mr. Peter John Edward Bendell, 83 Woodlands, London, N.W.11; Miss Anita-Dawn Blackwell, 51 Highfield Crescent, Abergavenny, Mon.; Mr. Michael John Copland, 288 Mumbles Road, Westcross, Swansea, Glamorgan; Mr. George Davidson, London School of Hygiene & Tropical Medicine, Keppel Street, Gower Street, London, W.C.1; Mr. William Rodney Dolling, 61 Rede Court Road, Strood, Rochester, Kent; Mr. William Enotiemwomwan Eguagie, Imperial College Field Station, Silwood Park, Sunninghill, Berks.; Mr. Gazi Hariri, Rothamsted Experimental Station, Harpenden, Herts.; Mr. Richard Henry Hulls, Hillfield, Hartpury, Gloucester; Miss Phyllis Kerstein, Advanced Exterminating Service, Inc., 2464 East 75th Street, Chicago, Illinois, 60649, U.S.A.; Mr. Robert John Kosky, 10 Mayrose Crescent, Brighton, S.6, Victoria, Australia; Mr. Frank Mitchell, School House, Diddlebury, Craven Arms, Shropshire; Miss Pamela Mary Ovenden, 8 Ashley Drive, Hodge Lane, Hartford, Northwich, Cheshire; Miss Elizabeth Jane Rankin, Craigmillar, Hemsworth, Pontefract, Yorks.; Mr. Satya Ram Singh, Imperial College Field Station, Silwood Park, Sunninghill, Berks.; Miss Lindsay Anne Denning Sparrow, 30 Mayfield Gardens, Newington, Edinburgh 9; Mr. Kenneth Nelson Westbury, Rentokil Ltd., P.O. Box 395, Nassau, Bahamas; Mr. John Elwy Williams, 75 Hall Street, Rhoclannerchrugog, Denbighshire.

The President said that no additional nominations for the vacancies for Officers and Council for 1965 had been received since the announcement of Council's nominees at the December meeting (1964, *Proc. R. ent. Soc. Lond. (C)* 29 : 35).

Mr. A. F. Amsden, Mr. J. S. Badmin, Mr. W. R. Dolling, Mr. W. E. Eguagie, Miss E. J. Rankin, Mr. S. R. Singh, Mr. M. F. Walker and Mr. S. A. Williams signed the Obligation Book and were admitted fellows of the Society.

The Hon. Miriam Rothschild exhibited an oscillogram made by Mr. John Moorhouse from a tape recording of the Garden Tiger Moth (*Arctia caja* L.) stridulating, together with coloured slides of the moth taken during the display accompanying stridulation.

Miss Rothschild said that when disturbed, particularly after a long rest, the moth sometimes responded by walking forward and flapping its wings once or twice at fairly regular intervals, in a manner reminiscent of a butterfly sunning itself. During and following these wing movements it emitted a very low distinct rattle. It was not known precisely what stimuli triggered off the impulse to stridulate. So far no stridulatory organ had been found and it was suggested that the noise might be produced by a muscular contraction of the thorax aided or produced by the wing movements.

Miss Rothschild suggested that an aposematic moth such as the Garden Tiger, which has resorted to a chemical defence mechanism, must have a warning display which can be used against not only birds and bats, but also small ground predators which either are not endowed with keen colour vision or have nocturnal habits. It should be remembered that Tiger Moths were on the wing for only relatively short periods of darkness.

In the discussion which followed Dr. P. T. Haskell said that his original doubts were resolved and he was now happy to accept Miss Rothschild's evidence that the Garden Tiger Moth actually did stridulate. He felt sure, however, that she would agree that there was still some way to go to explain how and why it did so. The oscillograms of the stridulation were interesting because they showed a similar wave pattern to that of the wing beat. Possibly the mechanism was that after the wings had been laid to rest in the normal display position the moth kept contracting some of the wing muscles and in doing so distorted part of the thorax so as to produce the noise. Dr. J. Simpson of the Bee Department, Rothamsted Experimental Station, believed that this was how some bee sounds were made. The difficulty in explaining the purpose of the moth noise arose because it was of low intensity and frequency and would not be detectable by the tympanal organ of other insects. It had occurred to him that if the noise was in fact a part of defensive behaviour it might be detectable by some predators (e.g. spiders) through the substrate on which the moth was sitting.

The President recalled that Simpson's work on the queen bee, and also similar work on the sound produced by the blow-fly, had been attributed to deformation of the thorax.

Mr. D. Leston asked whether the phenomena were just noises incidental to the warming up process preparatory to flight and whether the moths could produce sudden noises. Dr. Haskell agreed that the stridulation was strictly a noise since it did not occur in a repeated, regular pattern; it came at the end of the usual display behaviour and the moths could not produce sudden noises. Mr. Leston added that this, and the fact that the noise was made by both sexes, suggested that it was a factor in warning behaviour. Dr. Haskell emphasised that, although there were now many records of Arctiids producing noises in all sorts of circumstances, it was not really clear why they did so. Miss Rothschild added that stridulation was triggered off on disturbance from a deep sleep and was not repeatable after subsequent brief periods of rest.

Mr. R. J. A. W. Lever made a short communication on the part played by insects in the diet of the fox.

Between 1956 and 1958, 420 fox stomachs and 120 droppings were examined for insect remains. These were found to occur throughout the year (but were most abundant between June and August) and to be present in 25 per cent. of the stomachs examined.

The remains, which were too mixed and fragmentary to enable numbers of individuals to be recorded, were composed mainly of beetles, in particular Carabidae and Geotrupidae. The former were more abundant in foxes shot in lowland, wooded counties such as Kent, and the latter in foxes shot in hilly, moorland areas in Westmorland. Species most frequently

represented were *Carabus violaceus* L., *C. problematicus gallicus* Géh., *Geotrupes stercorarius* (L.) and *G. spiniger* Marsh. On a few occasions remains of weevils (*Phytonomus*) and larval and adult Elaterids (*Athous*) were recovered.

The few lepidopterous remains consisted of caterpillars of *Apamaea monoglypha* (Hfn.) from Derbyshire and Herefordshire, and *Triphaena pronuba* (L.) from Cornwall, both tussock-feeding species with a larval stage lasting up to nine months. The only common dipterous remains were of larval *Calliphora erythrocephala* Meig., presumably taken by foxes eating from fly-blown carcasses, and the unexpected record of about 100–150 larvae of the Syrphid *Myathropa florea* L. found in the stomachs of two Cornish foxes shot in July and August. These latter favour pockets of water in the hollows and surface roots of beech trees for their breeding places, and it is not known whether the foxes imbibed them accidentally while drinking or consumed them deliberately. A few remains were also found of earwigs, Bibionid larvae and ants. The results of this survey agreed well with other records for Britain, North America and Norway.

A short discussion followed in which Mr. J. C. Hartley said that larvae of *Myathropa*, like other eristaline larvae, were very resistant to digestive juices and would stay alive for several hours in fixative solutions such as Pampel's Fluid. Thus they might be more persistent in the digestive tract of the fox and therefore be a disproportionately more conspicuous item than other insects.

There were two ways in which a fox might be able to collect fair numbers of these larvae. If the posterior spiracles at the end of the breathing tube, or tail, lost contact with the surface, then the larva often had to climb to, or float to, the surface to re-establish contact. This very often happened if the water level in the root pocket suddenly rose, as after heavy rain. Flotation of the larvae could also be brought about by stirring up the contents of the water hole. In either case all the fox had to do was to pick up the larvae from the surface of the water.

Mr. R. L. E. Ford said that some five years ago he had kept a vixen in captivity. Although she would play with beetles, and might have swallowed a few accidentally, she refused to eat any insects (Lepidoptera and beetles) offered to her. He wondered, therefore, how many insects were really eaten and how many merely taken accidentally. Mr. Lever replied that in view of the numbers of individuals recovered, he assumed they were taken deliberately, availability being a main factor. Carabids and Geotrupids had been recorded as the main food items elsewhere in Britain (Southern & Watson), eastern U.S.A. (T. G. Scott) and Norway (H. M-K. Lund). A captive fox regularly provided with an ample diet could be expected to shun beetles (perhaps acrid), whereas a wild fox obliged to hunt for all food items would doubtless snap up every edible object encountered.

Professor J. D. Gillett recalled that, whereas juvenile crocodiles fed largely on insects, the adults did not. He wondered if any analysis had been made of the proportion of insects eaten in relation to the age of the foxes. Mr. Lever said that not enough immature foxes were available to enable any conclusions to be drawn about differences in diet.

Mr. R. S. Balter gave a short talk on eggs of some primitive Amblycerans (Mallophaga) seen in relation to the successful *in vitro* culture of *Menopon gallinae* L.

He explained that, with the help of a fellow worker, Mr. R. T. Williams, the common poultry shaft louse *M. gallinae*, was successfully reared in the laboratory, an accomplishment which they thought to be original. From observations of these cultures, they were able to suggest that the mechanism of egg-laying seen in this louse was the most primitive known, and by comparing the structure of this egg with that of more advanced Amblycerans, were able to indicate some of the trends seen in the evolution of the Mallophagan egg. It was postulated that two structures, the pedicel and pre-opercular hooks, might be of great value in determining phylogenetic relationships.

Mr. M. Abdullah made a short communication entitled "Heteromera, a natural group of beetles". He said that for a long time students had speculated on the phylogeny of the blister beetles of the family Meloidae and as to whether the Heteromera was a natural group of the Coleoptera or not. The most conclusive evidence came from the discovery of *Protomeloe argentinensis* Abdullah (1964, *Ann. Mag. nat. Hist.* (13) 7 : 247–254). This discovery established

that the Meloidae had evolved from Anthicid ancestors. Two more species of the primitive Protomeloinae had now been discovered from Brazil. Of the known genera of Anthicidae, the one closest to the Protomeloinae was *Steropes* Steven (Steropinae). Examination of the primitive genera of the Pyrochroidae, and particularly the Madagascan *Incollogenius* Pic, suggested that the Pyrochroidae were related to the Anthicidae as well as to the Pythidae (*Ent. mon. Mag.*, in press). Dr. Roy Crowson's view that the Heteromera was a natural group was correct, and the placing of the related families Pythidae, Pyrochroidae, Anthicidae (including *Pedilidae auctt.*), Meloidae and Cephaloidae in different superfamilies was phylogenetically wrong.

The holotypes of *P. argentinensis* and *P. bicolor* were exhibited.

The President thanked these four speakers for their interesting contributions.

Dr. R. J. Wootton gave a paper making a plea for uniformity in insect wing nomenclature, an abstract of which appeared on page 37.

The President said that, as there was not sufficient time to do justice to the paper in discussion, he would like practical suggestions as to whether there was any possibility of getting some agreed procedure, at least within limited groups, and he invited preliminary suggestions as to how this might be done.

Dr. John Smart said that the value of Snodgrass' scheme lay in its recognising veins on the basis of the morphology of the characters at their base. The establishment of a uniform system was not just a question of making a table. He himself had found that published figures of the wings of *Periplaneta americana* disagreed with each other and with the actual situation in the insect. He thought Dr. Wootton would find that if he tried to establish a uniform scheme he would have to examine a chosen wing in each group and would not be able to start by using published figures.

Mr. M. Abdullah said that it was necessary to define valid criteria as a basis for establishing vein homologies.

Mr. D. Leston said that the argument was comparable to that which applied in systematics. It was necessary to decide whether a phenetic or phyletic system was required, but great complications were involved with the latter. There was also the philosophical argument that there was no evidence that uniformity was possible and the application of a "system" could stultify work. Possibly the time was not yet ripe for uniformity.

Replying to these comments Dr. Wootton said he agreed with Dr. Smart that some extensive detailed examination of a very large range of wings would be necessary. He was not so sure that this had to be done before a consistent naming system was sought. He agreed with Mr. Abdullah that valid criteria were needed. With regard to Mr. Leston's observations, a rigid naming system with all its faults would be a useful step forward. The Comstock-Needham system had been a help and although some of their suggestions had had to be rejected, there was still value in putting forward a scheme.

In thanking Dr. Wootton the President said he was sorry it was not possible to discuss the paper more fully; he felt the subject might be a suitable one for a discussion meeting.

DAVID R. RAGGE, *Honorary Secretary.*

ADDITIONS TO THE LIBRARY

Presented

- Annual Review of Entomology*, Vol. 10, 1965. 8vo. Palo Alto: Calif., U.S.A.: Annual Reviews, Inc., 1965. \$8.50. [Publishers.]
- CARTHY, J. D. *The behaviour of arthropods*. 8vo. Edinburgh & London: Oliver & Boyd, 1965. 21s. (paperback 12s. 6d.) [Publishers.]
- CUMMINS, K. W., & others. *Experimental entomology*. 8vo. N.Y.: Reinhold Publ. Corp., London: Chapman & Hall, 1965. £2 12s. 0d. [Publishers.]
- DANILEVSKII, A. S. *Photoperiodism and seasonal development of insects*. 8vo. Edinburgh & London: Oliver & Boyd, 1965. £3 10s. 0d. [Publishers.]
- DAVEY, K. G. *Reproduction in the insects*. 8vo. Edinburgh & London: Oliver & Boyd, 1965. 21s. (paperback 12s. 6d.) [Publishers.]

- EMERSON, K. C. *Checklist of the Mallophaga of North America (north of Mexico). Part I. Suborder Ischnocera. Part II. Suborder Amblycera.* 4to. Dugway, Utah: Dugway proving Ground, 1964. [The publishers.]
- GILMOUR, D. *The metabolism of insects.* 8vo. Edinburgh & London: Oliver & Boyd, 1965. 25s. (paperback 15s. 0d) [Publishers.]
- HICKIN, N. E. *Forest refreshed: the autobiographical notes of a biologist.* 8vo. London: Hutchinson, 1965. 25s. [Publishers.]
- HICKIN, N. E. *Household insect pests.* 8vo. London: Hutchinson, 1964. 30s. [The publishers.]
- PEARSON, R. *Animals and plants of the Cenozoic era.* 8vo. London: Butterworths, 1964. £2 0s. 0d. [Publishers.]
- ROCKSTEIN, M., Ed. *The physiology of Insecta. Vol. 3.* 8vo. N.Y. & London: Academic Press, 1964. £8 18s. 6d. [Publishers.]
- TUXEN, S. L. *The Protura: a revision of the species of the world with keys for determination.* 8vo. Paris: Hermann, 1964. [The publishers.]
- University of California Publications in Entomology. Vol. 28. *A revisional study of the bees of the genus Perdita F. Smith, with special reference to the fauna of the Pacific coast (Hymenoptera, Apoidea). Part VI.* By P. H. Timberlake. 8vo. Berkeley & Los Angeles: Univ. Calif. Press, 1964. \$5.00. [The publishers.]
- University of California Publications in Entomology, Vol. 39. *Skeleto-muscular morphogenesis of the thorax and wings of the honey bee Apis mellifera (Hym., Apidae).* By H. V. Daly. 8vo. Berkeley & Los Angeles: Univ. Calif. Press, 1964. \$2.00. [Publishers.]
- USSOVA, Z. V. *Flies of Karelia and the Murmansk region (Diptera, Simuliidae).* 8vo. London: Oldbourne Press, 1964. £4 10s. 0d. (Translation of Russian edition of 1961). [Publishers.]
- ZIMMERMAN, E. C., Ed. *Insects of Hawaii. Vol. 11. Diptera: Brachycera II—Cyclorhapha I. Dolichopodidae,* by D. Elmo Hardy and M. A. Kohn; *Phoridae,* by D. Elmo Hardy and Erwin Beyer; *Lonchopteridae, Pipunculidae and Syrphidae,* by D. Elmo Hardy. 4to. Honolulu: Univ. Hawaii Press, 1964. [Publishers.]
- ZUMPT, F. *Myiasis in man and animals in the Old World.* 4to. London: Butterworths, 1965. £6 10s. 0d. [Publishers.]

Purchased

- BOURSIN, C. *Die "Noctuinae"—Arten (Agrotinae vulgo sensu) aus Dr. h.c. H. Höne's China—Ausbeuten. ForschBer. Landes NRhein-Westf. Nr. 1170,* 1963. £6 7s. 0d.
- BROOKES, V. J., Ed. *Insect physiology. Proceedings of the 23rd Annual Biology Colloquium.* 8vo. Corvallis, Oregon: Oregon State Univ. Press, 1963. £2.
- BUHR, H. *Bestimmungstabellen der Gallen (Zoo- und Phytocecidien) an Pflanzen Mittel- und Nordeuropas. Band 1. Pflanzengattungen A-M, Gallennummern 1-4388.* 4to. Jena: G. Fischer, 1964. £8 8s. 0d.
- CHARARAS, C. *Le pin maritime: dépérissement général dans le Var. Etude du rôle des insectes, des conditions climatiques, des facteurs biologiques.* 8vo. Paris: Paul Lechevalier, 1964. £2. (*Encycl. Ent. (A) 40*)
- DAANJE, A. *Über die Ethologie und Blattrolltechnik von Deporaus betulae L. und ein Vergleich mit den anderen blattrollenden Rhynchiiten und Attelabinen (Col., Attelabinae).* *Verh. K. Ned. Akad. Wet. Nat.* 56 (1), 1964. £3. 8s. 0d.
- EHRlich, P. R. & HOLM, R. W. *The process of evolution.* 8vo. N.Y., etc.: McGraw-Hill, 1963. £3 9s. 6d.
- ENTOMOLOGICAL SOCIETY OF INDIA. *Entomology in India, 1938-1963.* 8vo. New Delhi: Ent. Soc. India, 1964. £2. (Silver Jubilee number of the Indian Journal of Entomology)
- FERNANDEZ, J. M. *Entomologia Canariense nuevas notas sobre biogeografía y la polilla de los alamos laguneros.* 8vo. La Laguna de Tenerife: Inst. Est. Canarios, 1963. £1.
- FISCHER, F. C. J. *Trichopterorum catalogus. Vol. V. Phryganeidae. Limnocentropodidae. Molannidae.* 8vo. Amsterdam: Ned. Ent. Vereeniging, 1964. £4.
- FLOCH, H. & ABONNENC, E. *Diptères Phlébotomes de la Guyane et des Antilles françaises.* 4to. Paris: Office de la Recherche Scientifique Outre-Mer, 1952. £3. (*Faune de l'Union française, XIV*)