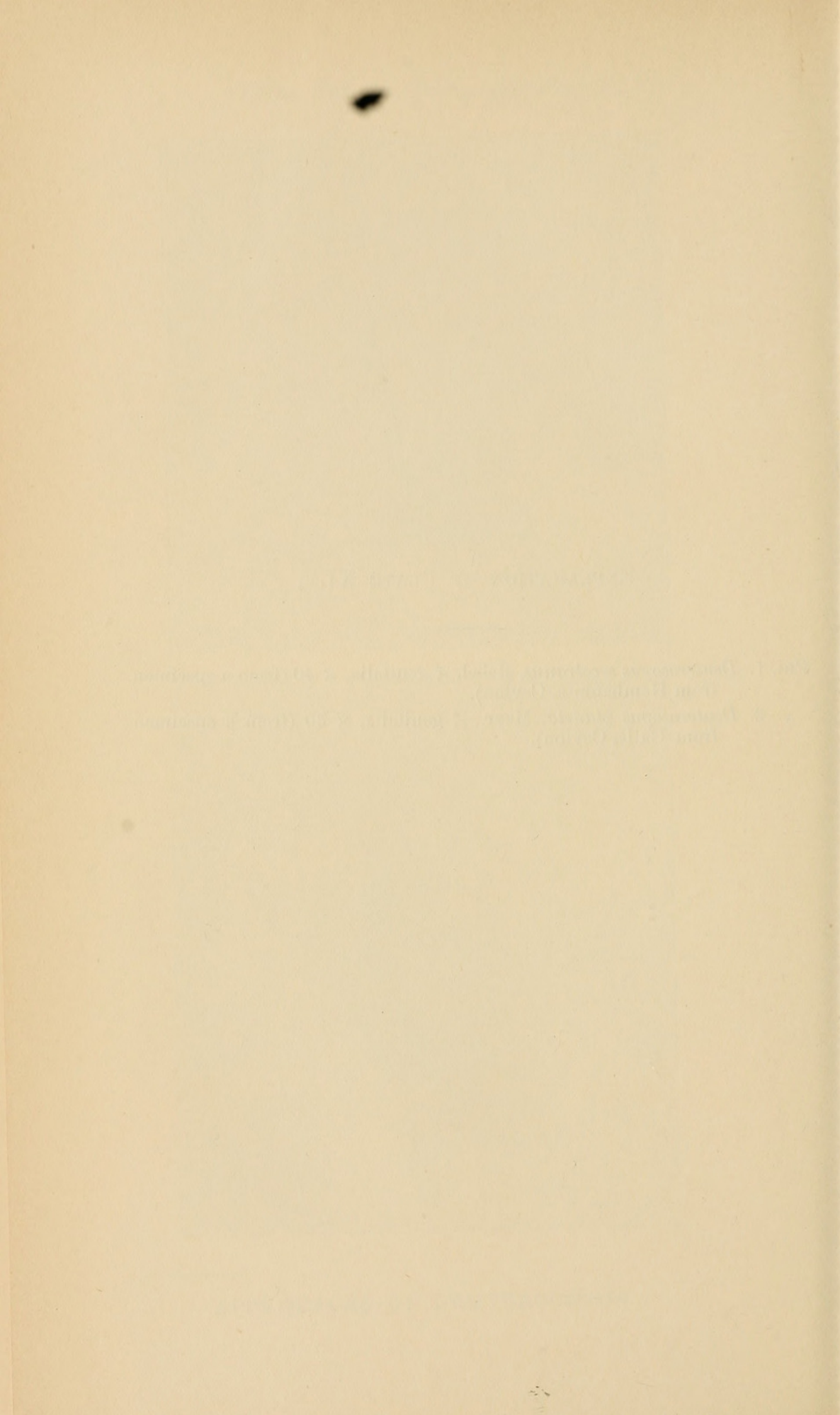


C. Hentschel.

APPENDAGES OF DEUTEROCOPUS.

EXPLANATION OF PLATE XLV.

- FIG. 1. *Deutero copus socotranus*, Rebel, ♂ genitalia, × 40 (from a specimen from Hambatonta, Ceylon).
,, 2. *Deutero copus planeta*, Meyr., ♂ genitalia, × 40 (from a specimen from Galle, Ceylon).



to $\frac{2}{3}$ length of segment, base of first subsegment cut transversely by a narrow inwardly-oblique white line, second segment with a large and conspicuous patch of pure white at about $\frac{1}{3}$ length of segment resting on dorsum but not extending to fore-margin of segment; dorsum of wing with a few scattered whitish scales between $\frac{1}{2}$ and white patch. Cilia on costa and at apex blackish, dotted with whitish on basal half, white opposite white spots; within first cleft dark reddish-ferruginous with a purplish tinge, with a few white scales around base of cleft and some darker scales exteriorly; on termen blackish; within second cleft pale reddish-fuscous on basal half of lower-margin of first subsegment, followed by a narrow whitish patch; around tornus blackish; on dorsum fuscous-ferruginous, with a slight purplish-fuscous scale-tuft at $\frac{3}{5}$, followed by a broad patch of pure white extending half-way to tornus.

Hindwing cleft from about $\frac{2}{3}$ and $\frac{1}{5}$, first and second segments sublinear, second segment with hinder angle nearly obsolete, third segment linear: golden-ferruginous: first segment wholly blackish, with a broad white spot at about $\frac{3}{4}$ opposite white patch on forewing; second segment wholly blackish; third segment about $\frac{2}{3}$ length of second, apical fourth dark-purple. Cilia blackish on costa; white at apices of first and second segments, pale-fuscous within cleft, pale-ferruginous on basal half of lower margin of second segment, on second segment with a narrow ferruginous-fuscous scale-tuft on lower margin at $\frac{1}{2}$, on third segment pale-ferruginous, its apex broadly surrounded by a dark purplish-ferruginous scale-tooth, and a few scattered dark purplish-ferruginous scales between scale-tooth and base on fore-margin and dorsum.

TYPE in British Museum Collection.

Habitat.—BRAZIL, Ega (*Bates*).

Observation.—In size, colour and general appearance *L. sochchoroides* exhibits a great resemblance to a species of *Sochchora* (*S. albipunctella*) which was also collected at Ega by Bates. Both show the same coppery-brown forewing, and both have a large and conspicuous white spot in about the same position, but whilst this spot in the *Leptodeutero copus* is on the dorsal margin of the forewing, in the *Sochchora* it is on the tip of the first segment of the hindwing. Thus the same effect is produced by two different methods.

EXPLANATION OF PLATES XLIV, XLV.

[See *Explanation* facing the PLATES.]

IV. *Some Experiments with Ants' Nests.* By HORACE ST. J. K. DONISTHORPE, F.Z.S.

[Read December 1st, 1909.]

A COLONY of ants may be founded in several ways—

(1) The most simple and ordinary method is that in which the queen ant, after her marriage flight, starts the colony herself. She relieves herself of her wings, either by brushing them off with her feet, or, as I have sometimes seen myself, by grasping them with her jaws, and removing them with a jerk. Selecting a suitable spot, she digs a small chamber in the ground or under a stone, and laying her eggs she tends them till the first batch of workers are hatched.

(2) The female, again, may obtain admission into a small queenless colony of a different species, and there bring up her offspring. When the host species has died out, there will remain a pure colony of the queen species. This has been called "Temporary Social Parasitism."

(3) The queen may also enter a small colony of another species, and killing the workers, take possession of the pupae. When these have hatched and have helped her to bring up her own brood, the mixed character of the nest is kept up by raids on the host species, which is commonly known as "slavery" in ants.

(4) A female may obtain admission into the nest of another species, and there permanently reside with her offspring, this has been called "Permanent Social Parasitism."

Now, as is well known, ants, as a rule, strongly object to the intrusion of strange ants, either of their own or of another species. Touch and smell are the two principal senses in ants, and the antennae are the chief organs in which they chiefly reside. Forel says the members of a colony know each other by smell and contact. Wasmann has called their antennae "touching noses," and says they do not know each other personally, but recognise each other by an intelligent "parole," a recognised form of antennae stroke. Miss A. W. Fielde has carried out a

TRANS. ENT. SOC. LOND. 1910.—PART II. (JUNE)

number of experiments to prove that each of the different joints of an ant's antennae has a different function. For example, the 12th or final joint recognises the home or nest odour, the 11th recognises personal relations, the 10th the path or track, etc. The authoress also concludes that the whole nest aura changes every two or three months. Though these experiments were very carefully elaborated, I do not think too much importance should be attached to them; and this, I believe, is the opinion of both Father Wasmann and Prof. Wheeler. The subject is far too difficult and intricate to be settled at once. Herr Bethe wished to prove that it was only by smell that ants knew each other, and he found that when they were washed in alcohol and water, dried, and bathed in a liquor of crushed ants from another nest, they were received by that nest. This, however, is only the case for a short time, the strangers being eventually killed. Also ants returned after similar treatment to their own nest are not recognised for a long time. Lord Avebury has pointed out that ants that had been soaked in water were not at first recognised by their friends.

Any careful experiments with ants' nests are therefore of the greatest value and interest, as a means of helping those who are endeavouring to clear up these difficult problems. I will now give the results of some experiments with ants' nests, which touch on the different points discussed above.

On April 2nd, 1907, I established a nest of *Formica rufa*, from Oxshott, in my study. It contained 12 ♀ ♀ and many ♂ ♂, etc. On April 12th I brought up from the same nest at Oxshott, some more ♀ ♀ and ♂ ♂. They were at once recognised and received with pleasure, the ♀ ♀ being cleaned and led into the nest. On April 26th, I brought up a ♀ and some ♂ ♂ from another nest at Oxshott, far removed from the first nest. These also, to my surprise, were equally well received.

These ants must have sprung from the same stock, since ♀ ♀ and ♂ ♂ from Weybridge and Bournemouth were attacked, and dragged about and killed. I have also been in the habit of obtaining ants in the spring from the same nests I took them from the year before and introducing them into my observation nests, and always found them well received and undoubtedly recognised. I extract the

following from one of my note-books—"May 19th, 1907. Took part of a nest of *F. rufa* at Weybridge"; then later on, "April 7th, 1908. Got some more *débris* from the same nest at Weybridge, 4 ♀♀, ♂♂, etc.; ants all well received." This is the *rufa* nest I have still, which is doing very well.

Mr. Keys, of Plymouth, when starting some observation nests of *Formica rufibarbis* v. *fusco-rufibarbis* from Whitsand Bay, told me that he mixed ♀♀ and ♂♂ from different nests in that locality, and that they agreed perfectly well together. These facts look as if the "recognition method" is inherited in a common stock, and also appear to disagree with the theory of the progressive odour of ants.

In the "Ent. Mo. Mag." for April and May 1909, Mr. Crawley publishes some experiments with *Lasius* species, ants which found their colonies in the simple or primitive method. He records cases where queens of *Lasius umbratus* were accepted by colonies of *L. niger*.

On May 17th, 1907, I obtained and fixed up in a large glass bowl, a nest of *Formica sanguinea* from Woking, which contained very few slaves, and all the ♂♂ were of a small type. (The nest contained over 60 specimens of *Lomechusa strumosa*, which may account for the small size of the ♂♂, though no pseudogynes had yet been produced.) Large *sanguinea* ♂♂ taken from a nest at Woking, quite near to this one, were all dragged about and killed when introduced into this observation nest.

In this case workers of the same species from another nest in the same locality were attacked and killed.

On April 17th, 1909, I took a small nest of *Formica rufibarbis* v. *fusco-rufibarbis* at Whitsand Bay. It contained a ♀ and about 25 ♂♂, and I put them into a small plaster nest on April 22nd. No eggs were ever laid by this ♀. On June 1st I removed some of the ♂♂ and introduced them into a small bowl which contained sand and a ♀ of *F. fusca* taken at Bradgate Park on May 3rd, 1909. This queen had laid a few eggs in a small chamber underneath a piece of damp sponge. On June 27th, I introduced the rest of the *rufibarbis* v. *fusco-rufibarbis* ♂♂. The queen was not attacked, and on July 4th all the ♂♂ had collected under the sponge with the queen. On August 3rd I liberated them all at Ryde in the Isle of Wight.

In this experiment a *fusca* ♀ was adopted by workers of a different race from a different locality.

On July 14th Mr. Keys sent me up several different nests of *F. rufibarbis* v. *fusco-rufibarbis* from Whitsand Bay, which contained many pupae. On August 10th I allowed two of these colonies, which I had placed in separate compartments of a combined Fielde and Jannet nest, to mix, by removing the obstruction in the passage between the two compartments. They were all quite friendly, and eventually collected all the pupae that were left (many ♂♂ had hatched from the others) in one side of the nest.

Here two colonies from different nests in the same locality combined at once when allowed to mix with each other.

On May 9th I took 5 ♀♀ and a number of ♂♂ from a nest of *Formica sanguinea* at Woking. These I eventually put into a large bowl with sand, and a damp sponge. The ants burrowed into the sand under the sponge. On July 23rd I introduced many winged ♀♀ and ♂♂, some pupae and a few ♂♂ from a *sanguinea* nest at Bewdley Forest. None of these were attacked! On July 25th the Woking ♀♀ were up under the sponge, and all the ants were together with the pupae.

Here ants of the same species from quite a different locality mixed quite peaceably together. This is very strange; it may be that as the first colony were under the sand, and did not come up till two days after the second lot of ants had been introduced, the latter may have acquired the smell or nest aura. Also the first nest was not very strong as many of the ♂♂ had died. In any case I can only state what actually occurred.

On April 21st I put a number of ♂♂ of *Lasius flavus*, which I had brought up from Whitsand Bay, into a glass bowl with sand. On May 6th I introduced two ♀♀ *flavus* from Bradgate Park, these were accepted by the ♂♂, and on May 8th eggs were laid in a small chamber under a bit of damp sponge, and the ♀♀ were attended by the ♂♂. A ♀ *flavus* from Portland was attacked and killed when introduced. The nest was eventually destroyed by mould.

In this experiment ♀♀ of the same species were accepted by ♂♂ from a different locality in a nest without a ♀.

On June 1st Mr. Forsyth sent me up from Portland a large nest of *Lasius flavus*, which contained 3 ♀♀ many ♂♂, eggs and pupae, and some 50 *Claviger foveolatus*. I kept the main nest in a large glass bowl with sand, and put 2 of the ♀♀ and a dozen ♂♂ and

Clavigers into a small plaster nest for observation. From June 1st till the end of August I kept introducing ♀ ♀ from the main nest into the small plaster nest, and they were always recognised and well received. On August 9th I introduced ♀ ♀ of *Solenopsis fugax* taken with *Lasius niger* at Sandown. These were all killed by the *flavus* ♀ ♀.

Here we see that ants from the same nest, separated for some time, were recognised and well received when brought together again. The experiment with *Solenopsis* was perhaps too severe a test, as the little parasitic ants had nowhere to hide in the plaster nest.

I now come to my experiments with nests of *Formica fusca* and *rufibarbis* v. *fusco-rufibarbis* and ♀ ♀ of *Formica sanguinea*. The modern view of the foundation of colonies by the *Formica rufa*, *sanguinea* and *exsecta* group supposes that the ♀ after her marriage flight enters a small nest of *F. fusca*, or one of its races, and takes possession of the pupae, being accepted by the workers, or killing them if they prove to be antagonistic. This opinion is held, I believe, by both Father Wasmann and Prof. Wheeler. It is certainly the case that no one has ever witnessed, either in Europe or America, a ♀ of the *rufa* group founding a colony by herself, as may be seen in *Lasius* and *Myrmica*, etc. I have observed quite small nests of *F. rufa* at Weybridge, which appear to have been quite recently formed, but I believe these to have split off from older nests, of which there are large numbers in the locality. I have also seen individuals of this species at Buddon Wood moving the whole nest to a new situation; the pupae and entire contents of the nest and most of the nest materials being carried bodily away. For fifteen years I have known a very large nest at Weybridge. A few years ago a part of the ants in this nest moved to a spot close at hand. This year the ants in the old portion have moved to another spot near to the first new settlement, the old nest being deserted. Nests may spread in this way, but this has nothing to do with the founding of a colony by a single queen. I have no doubt some of the young queens return to the old nest after their marriage flight, but the problem is to ascertain the fate of those that do not. In order to test this question in the most exhaustive manner, we require a young female just after her marriage flight, and also a small, or impoverished, *fusca* nest. The



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