A BRACONID PARASITE ON THE PINE WEEVIL, *HYLOBIUS ABIETIS*.

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THE following notes are the result of observations made on pine weevils and parasites collected in a plantation on the estate of Banchory Devenick near Aberdeen. The plantation in question was formed in the spring of 1911, a year after the removal of the old crop which was a pure wood of Scots pine. The stumps and roots of this old wood afford ideal breeding places for the pine beetle (*H. piniperda*) and the pine weevil (*Hylobius abietis*), and they are to be found in considerable numbers.

Fig. 1. Larvae of *H. abietis*. $\times 6$.

The work of the pine weevil is familiar to all interested in forestry. It is harmful only in the adult state and does considerable damage by gnawing the tender bark of young conifers causing them to wilt and die. Where conifers are not to be got it will readily attack birch, mountain ash, and oak.

In the larval stage *Hyllobius* is harmless. The adult deposits her eggs in or under the bark of the stumps of various conifers but prefers Scots pine. The larva on hatching out, commences to tunnel between the bark and the sapwood, and when full grown pupates at the end of this tunnel, either in a cavity or hook gallery in the sapwood, or in a cavity in the bark. The tunnels are filled with frass, consisting of tiny chips of wood bitten out by the larva and passed through its body.

Fig. 2.

a, b. Larvae of *B. hyllobii*. $\times 12$. (*a* after first moult. *b* after second moult.)
c. Pupa of *B. hyllobii*. $\times 12$.

The whole of the larval life is passed in such a tunnel. In the spring of 1912 I noticed a few tiny cocoons lying in one of these tunnels but I attached no importance to them at the time. In July of last year, however, I found several weevil larvae apparently in the resting stage, which were attacked by a small legless maggot feeding externally on

them. I collected a number of weevil larvae both attacked and immune, and also a number of the attacking maggot. In some cases the weevil larvae were sucked quite flat and in a few days all those which had been attacked were in this condition. Accordingly I supplied the parasitic larva with more grubs and found that they readily fed on them, crawling two or three inches to reach their new prey.

These parasitic larvae measured somewhat over $\frac{1}{4}$ inch in length, and were covered with very short reddish brown hairs. Unfortunately I was unable through lack of proper instruments to make a close examination of them and I could not make out the mouth parts. Observation showed, however, that they fed through the skin of their host and were purely external parasites. In September the parasites ceased feeding, and a few days after they moulted and became more definite in shape, and I assumed then that they were Hymenopterous. A fortnight later, on September 25th, they commenced spinning silky cocoons and in a few hours they were completely hidden. All through the winter I examined a few of these cocoons every week, but no alteration in the external appearance of the enclosed larvae was visible until February 20th, when in two out of five cocoons I found pupae. Nine days later the first imago emerged which I recognised as a Braconid of some sort. At the date of writing, April 14th, flies are still emerging from the later gathered cocoons.

Dr MacDougall informs me that three years ago he obtained a Braconid parasite on *Hylobius*, but in such a battered condition as to be unrecognizable. So far as I have been able to ascertain I know of no other British record of a Braconid on *Hylobius*. In Ratzeburg's *Ichneumon der Forstinsekten*, however, there is a short account of the rearing by Nordlinger of 40 ♀♀ and 4 ♂♂ from the larvae of *H. abietis*. I may be permitted to quote Ratzeburg's account. "Nordlinger bred 40 ♀♀ and 4 ♂♂ from this species (*Hylobius abietis*) each of whose larvae supports about ten parasites. The cocoons of the latter are firm, oat-shaped and papyraceous, woven among their hosts frass and dead bodies, and often constructed at the end of the beetles' tunnels beneath fir bark." This description agrees in every respect with my own observations and accordingly I looked up Ratzeburg's description of the species which he calls *Bracon hylobii*. It again agrees with the insects I have bred out, and as I have been unable to identify my specimens with any of the Bracons in the South Kensington collection, or with those described by Marshall, I think it highly probable that the species I have reared are

B. hylobii. If so they are a species new to Britain, and in order to be sure of this I have sent specimens for identification to Dr Szepligeti in Budapest.

Ratzeburg's description of the species is as follows: "*B. hylobii*. $1\frac{1}{2}$ – $2\frac{1}{2}$ mm. Outer and inner discoidal cells equally long. Second cubital cell a little larger than the first. Antennae of ♀ 31 jointed. The ovipositor as long as the abdomen and tending to curve upwards. Head approximately as broad as the thorax. All the legs and the greater part of the first half of the abdomen reddish brown. In the ♀ only the middle of the first segment is black. In the male the first

Fig. 3. *B. hylobii* ♂. $\times 15$.

ring may be almost quite black and the last or posterior half of the abdomen in both sexes is quite black. The thorax and head black except in certain females when part of it is brownish."

Ratzeburg expresses doubt as to making it a species, but he considers that the shape and size of the discoidal cells entitle it to that distinction from its near neighbours *B. immutator* and *B. spathiformis*.

Messrs Elliott and Morley in their Hymenopterous parasites of the Colioptera refer to Ratzeburg's species but do not quote his description. These references are the only two I have been able to obtain on the subject¹.

¹ Brischke, C. G. A. Die Ichneumoniden der Provinzen West- und Ostpreussen. *Schrift. Naturforsch. Gesell. Danzig Neue Folge*, v, 1882, p. 135 (records the ♀ of *Bracon hylobii* but makes no comments thereon).

The degree of parasitism by *B. hylobii* on the pine weevil may be of interest. In winter 1911 I observed no cocoons. In the spring of 1912, two years after the old crop was removed and presumably in the second year of the beetles' occurrence there, I observed a few cocoons, while in 1913 and 1914 every third pupating chamber was occupied by them. This represents parasitism in the third and fourth years of the pest of over 30 per cent.

I think I do not exaggerate when I suggest that *Bracon hylobii* Ratz. may prove of considerable value in combating the pine weevil, which is every year becoming more and more common in newly formed

Fig. 4. *B. hylobii* ♀. × 15.

plantations, especially in Scotland. The parasite is, in all probability, fairly common where *Hylobius* is found. The fact that it has hitherto apparently been unrecorded does not imply that it is scarce. The persons most interested in *Hylobius*, the forester and the factor, are interested only in the adult beetle when it begins its attacks on their plantations, and any measures they may take against it are as a rule confined to the trapping and collecting of the adult. The larvae are rarely considered, and though they were disturbed and examined, the forester is neither sufficiently interested nor sufficiently educated to pay any attention to the cocoons, or larvae of a parasite, though he found them.

Parasites have already been used with success in combating other destructive insects ; notably Professor Lefroy's introduction of *Rhogas Lefroyi* into the Punjaub, to combat the boli worm, and more recently Pierce and Townsend have shown that Hymenopterous parasites play a very important part in controlling the cottonboll weevil in the States. Pierce found that of 2800 weevils, 591 were parasitised, and that of these, in 525 cases the parasite was a Braconid. In 1911 Pierce and Hunter began experiments on the rearing and distributing of the parasites but I am not aware whether a report on these has yet been published.

As to the possibility of using *B. hylobii* in combating *H. abietis*, I have not yet obtained a sufficient knowledge of the former's life-history to make any definite statement, but such observations as I have been able to make lead me to believe there are no special difficulties to overcome. If *B. hylobii* is fairly or reasonably common, and there is no reason to suppose it otherwise, there should be little difficulty in obtaining batches of its cocoons, or numbers of its larvae to breed from. The larvae of *Hylobius*, too, can readily be kept alive if they are not removed from the roots on which they are feeding. I have reared several weevils by removing the smaller roots containing their larvae and keeping these sufficiently moist. The parasite itself is easily reared inasmuch as I bred one batch in an ordinary collecting tube in which I placed a weevil grub as food.

Out of about 70 cocoons, I have obtained no hyperparasites on the Braconid. This again is favourable. The parasite too is evidently hardy. The plantation from which my specimens were obtained is a bleak hillside near the coast and over 600 feet above sea-level. It is often swept by cold North and East winds.

Another interesting fact is that *B. hylobii* attacks the weevil larva in its resting stage, at a time when the latter is practically inactive.

The greater increase in numbers of the parasite as compared with the weevil is also interesting. Every weevil grub attacked gives rise to at least five adult parasites. Of these according to Nordlinger's figures, 90 per cent. will be females, but from my own observations 60 per cent. is a more probable relation.

Assuming that every weevil grub parasitised gives rise to five adults, three of which are females, and that as in the present instance, 30 per cent. of the weevil grubs are attacked in the winter 1913-14, then out of 100 weevil grubs we should get 70 *Hylobius* adults and 90 female Braconids in spring 1914. If we assume further that the rate of increase of *Hylobius* and of *Bracon* in a given year is the same, say

ten, and that the proportion of males to females in the two insects is the same, then we should have in the winter 1914-15, 420 weevil grubs and 540 Braconid. This would, therefore, entail the complete destruction of the weevil. These figures are of course purely hypothetical. Now it is by no means improbable that the Braconid is more prolific than the weevil, and also that the proportion of females to males in the Braconid is greater than in the weevil. These, however, are points which must be cleared up before the practical value of *Bracon hylobii* as a factor in controlling *Hylobius* can be fully demonstrated.