20 to 40 kR of γ-rays would be necessary to induce a sufficiently high rate of lethal factors or sterility of the males. In order to reduce a natural population of *Z. diniana* noticeably, the released males would have to outnumber the natural males considerably. Thus the technique could only be applied when the natural populations reach a point of minimum density. However, unpublished results of male captures in sex traps by VON SALIS indicate that even at an extremely low population density (1 larva per 400 kilos of larch twigs[6]) the moth populations are higher than one would except from the data of the larval census. Without further control measures it would therefore be very difficult to produce and release such a number of irradiated males as would be necessary for the control of a large area. The application of conventional insecticides being out of question, a further reduction of the minimal populations during the larval stage might be necessary. This coud be achieved by microbiological control methods[7]. Unpublished field experiments by BENZ and AUER indicate that about 90% larval mortality can be achieved by the application of a preparation of *Bacillus thuringiensis* in combination with its exotoxin. However, this method would be expensive. Whether or not a reduction of the natural male populations by precapture in male traps baited with virgin females or the sex pheromone would be practicable in the field has to be investigated.

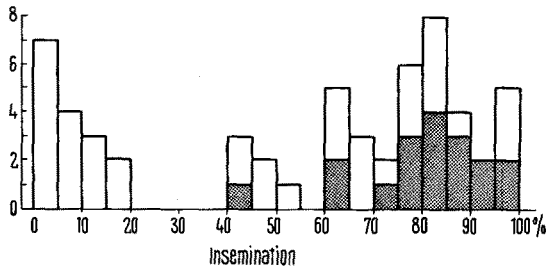

Fig. 2. Histogram of mated females with percentage of insemination (abscissa) of their eggs. Each column represents a class of 5%; the height indicates the number of females per class. Dark columns, females caged with 2 to 7 normal males. White columns, females caged with a normal plus 1 to 6 irradiated males.

Zusammenfassung. Bestrahlung von Männchenpuppen des Lärchenwicklers mit 40 kR induzierte in den Spermien so viele Letalfaktoren, dass nur eine sehr kleine Nachkommengeneration heranwachsen konnte. Bestrahlung mit 20 kR ergab eine relativ grosse männliche und eine prozentual geringe weibliche F_1. Letztere unter sich gekreuzt ergab praktisch keine Nachkommen. Zwei kleine Vorversuche lieferten Schätzwerte über den populationsdynamischen Effekt verschieden hoher Proportionen von bestrahlten zu unbestrahlten Männchen[8].

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Sex-Pheromones in *Bradysia tritici*

The sex-pheromones had been described in many orders of insects, mainly in orthoptera, lepidoptera, coleoptera, hymenoptera and some diptera[1-8]. Chemically they were described mainly as unsaturated alcohols and their esthers, aliphatic acids and terpene-like compounds[9]. A number of pheromones have been found to be lipids[5]. In all the cases, the substances must be volatiles. In the majority of the cases, pheromones are produced as liquids and they evaporate into the air and form a cloud of vapor over the animal[5].

In some insects, the production and the response to sex attractants are under hormonal control and are regulated by the corpora allata; they elicit alertness, sexual excitement, antennal waving, and wing raising, as well as courtship[6,7,10-12]. Our purpose was to investigate whether pheromones also occur in the family Sciaridae and, if so, in which sex.

In order to verify the possibility of existence of a pheromone of sexual attraction in *Bradysia tritici* (*Sciara ocellaris*), pupae were individually isolated in culture glass tubes to obtain virgin flies. When the flies hatched, males and females were separated. We also used non-virginal flies to verify whether or not there were differences in behavior between these flies and the virgin ones.

The female flies were placed in little glass tubes for $1^1/_2$ h, while the male flies were placed in other tubes for the same time, and other glass tubes without animals were used as controls.

We used rectangular boxes made of transparent plastic containing food; the boxes had lateral holes, in which the glass tubes could be introduced (Figure).

Males or females were placed into the boxes. The glass tubes, in which the flies remained for $1^1/_2$ h, were introduced into one of the box holes, immediately after removal of the flies. In the other hole, we introduced the control glass tube which had not had flies in it. When the flies in the box were males, those which remained in the glass tubes were females, and vice-versa. We made 5 types of experiments:

Glass tube	Plastic box
virgin males	virgin females
virgin males	non virgin females
non virgin males	non virgin females
virgin females	virgin males
non virgin females	virgin males.

During 10 min we counted the number of flies which entered the glass tube (experimental and control). As the flies were not marked, the counting included also cases in which the same fly entered more than once. The results obtained for *Bradysia tritici* are shown in Tables I and II.

These results show that virgin females of *Bradysia tritici* produce some aromatic substance to attract the males. The odour seems to disappear as a result of the copulation. We repeated the experiment using females (virgins or non-virgins) in the plastic box and glass tubes

with males odour (virgins or non virgins). The results were similar in the experimental and in the control glass tubes, indicating that males do not produce a substance with this effect.

In order to determine the part of the animal which is responsible for the production of this substance, the head of the females were cut and placed in a glass tube while the bodies were put in another glass tube.

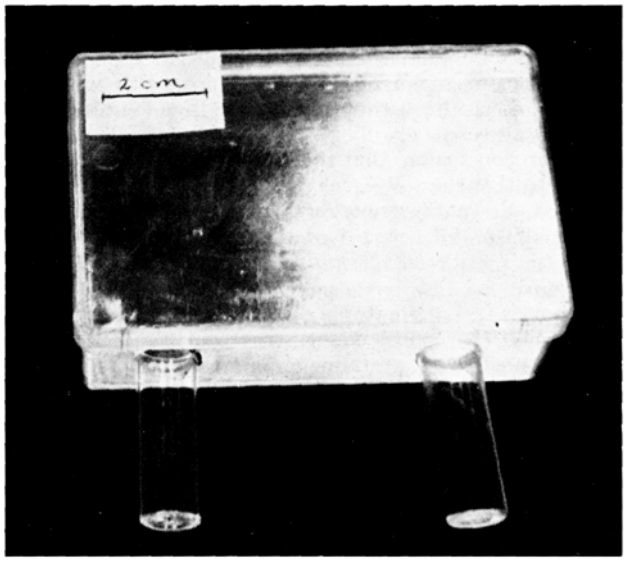
As can be seen in Table II, the body is probably responsible for the production of the pheromone and probably this substance is spread all over the animal; this would perhaps explain the smaller, but considerable, number of flies that entered the glass tubes with heads of females.

The males that entered the glass tubes with the bodies of virgin females tried, sometimes successfully, to copulate with the headless females.

In order to verify whether this phenomenon also occurs in other species of the family Sciaridae, we repeated these experiments with *Bradysia hygida* and with *Rhynchosciara angelae*. So far our results show that there is no sex-pheromone in these species.

Sex-pheromones have been found in many orders of insects. In some bark beetles there are species which hybridize in the laboratory but not in natural conditions. The species have different pheromones[8]. LANIER[8] has shown that sex attractants tend to prevent natural hybridization between these species and that specificity is greater under field conditions. In nature, pheromones providing encounters or identification of males and females certainly increase the probability of mating. In this way, in the interactions of some species with their environment, probably there is a dependence on olfactory perception for survival[8]. Although a great number of experiments with pheromones have been done recently, one has no idea of the extent to which these substances occur in nature. It seems clear, however, that they contribute to reproductive isolation of species as well as to increase the reproductive fitness.

Bradysia tritici belongs to the same family as *Rhynchosciara angelae* and *Bradysia hygida*, being also from the same genus as the latter. In *B. tritici*, the production of sex-pheromones probably is one of the trends followed by nature for speciation[13].



Box in which the animals were placed to test sex-pheromone. In one of the little glass tubes was the odour of the fly, and the other was control.

Table I. Boxes with males, glass tubes with female odour

Number of virgin ♂ used	Number of ♀ used	Number of ♂ that entered the glass tube with female odour (10 min)	Number of ♂ that entered the control glass tube (10 min)
24	17 (virgins)	36	3
17	20 (virgins)	33	1
10	15 (virgins)	17	0
9	12 (virgins)	54	4
16	4 (virgins)	48	4
10	10 (non virgins)	1	0
10	26 (non virgins)	1	1

Table II

Number of virgin ♂ placed in the plastic box	Number of ♂ that entered the glass tubes with 9 bodies of virgin ♀ (10 min)	Number of ♂ that entered the glass tubes with 9 heads of virgin ♀ (10 min)
30	28	8
30	27	7
30	12	6

Résumé. La présence d'un phéromone d'attraction sexuelle dans une espèce de diptère, *Bradysia tritici*, avec des considérations sur l'importance de cette substance dans la formation des espèces est décrit.

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