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A case of mating between *Plodia interpunctella* Hübner and *Ephestia kühniella* Zeller (Lepidoptera Pyralidae).

Abstract - A case of a natural mating between a male of *Plodia interpunctella* and a female of *Ephestia kühniella* is reported. Even though the moth species are very close, it is the first time such an event is mentioned in literature.

Riassunto - *Un caso di accoppiamento tra* Plodia interpunctella *Hübner e* Ephestia kühniella *Zeller (Lepidoptera Pyralidae)*

Viene segnalato un caso di accoppiamento spontaneo tra un maschio di *Plodia interpunctella* ed una femmina di *Ephestia kühniella*. Nonostante che le due specie appartengano a generi vicini, è la prima volta che un caso del genere è segnalato in bibliografia.

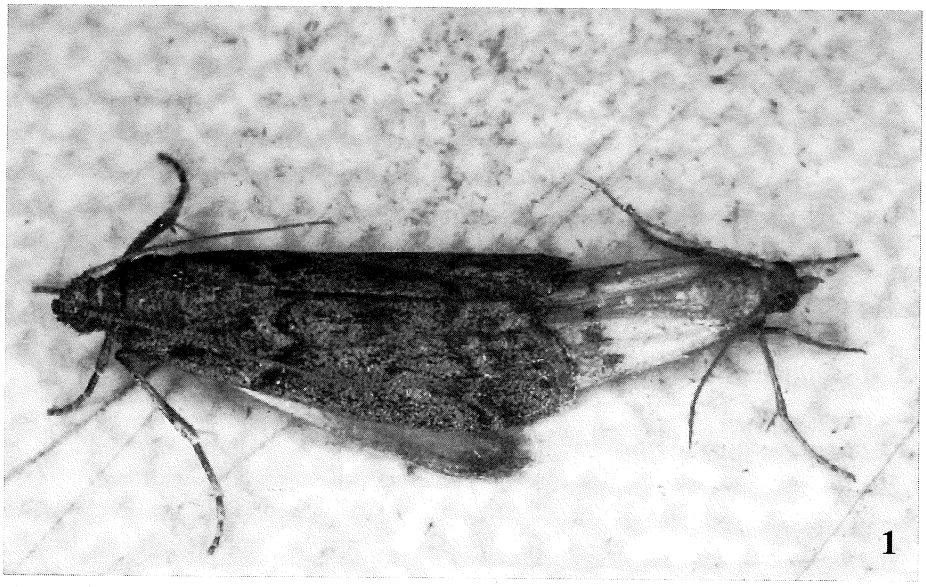
Key words: *Plodia interpunctella, Ephestia kühniella*, intergeneric mating.

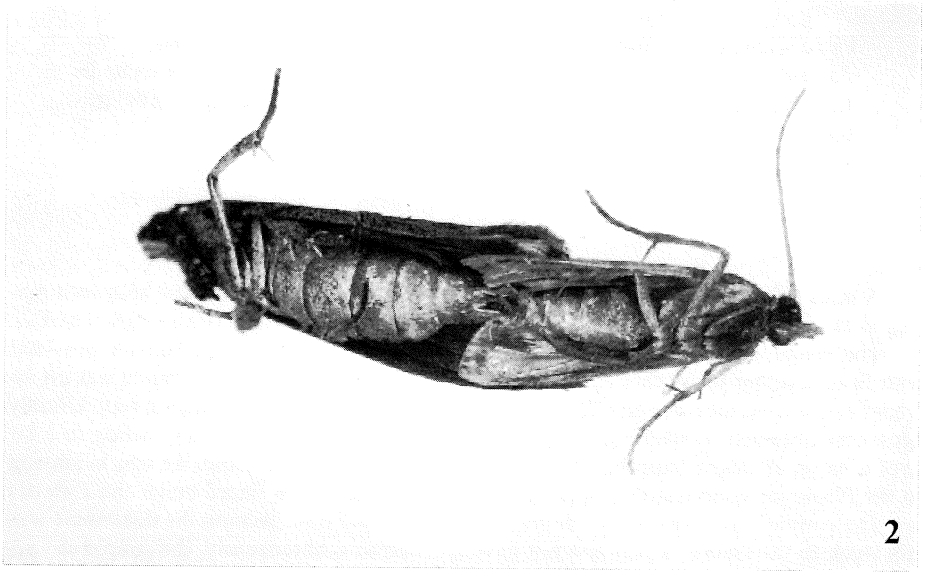
A male of *Plodia interpunctella* and a female of *Ephestia kühniella* have been seen mating in the rearing laboratory of the Entomological Institute of Milan (Italy) (figs. 1 and 2).

The couple mating was found in a petridish (14 cm diameter, 1 cm height), provided with food together with other *Ephestia kühniella*. Obviously the male of *Plodia* was an intruder and its presence was only due to an egg contamination in the following way. Usually eggs were obtained by confining adults, taken randomly from laboratory rearing in a jar over a sieve. It might happened that because the jars were too close, an egg belonging to the *Plodia* jar accidentally dropped inside the collecting plate placed under the *Ephestia* jar. The couple was isolated and photographed. The next day, because the dead male was still stuck to the female, separation not having occurred spontaneously, the couple was separated by a slight pressure. The male was immediately dissected while the female was put inside a frigde box (12 cm diameter and 5.5 cm height) provided with food at 26°C and 75% R.H in order to favour egg oviposition and may be later development of progeny. Three days later the female was found dead and therefore dissected.

The male and female copulatory apparatus examined under microscope appeared normal and presented no strange conformation.

No progeny came out from the female.





Figs. 1-2 - *Ephestia kühniella* Zell., female (left) and *Plodia interpunctella* Hb., male (right) while mating. Dorsal view (fig. 1). Ventral view (fig. 2).

DISCUSSION

For a long time it has been thought that the highly specific shape of structures and appendages of male and female copulatory apparatus constitutes a decisive mechanical factor in species isolation, acting as a system of key and lock (Wilde, 1964). But later on, it was proved that lots of factors lead to the copulatory act such as the mutual stimulation of specific sensory sites. Indeed in the case of mantids (Roeder, 1935; Roeder et al., 1960) removal of the inhibitory effect of the brain by decapitation greatly facilitates copulation. Grandi (1951) pointed out examples of several cases of sexual instinct aberration: interspecific and intergeneric mating such as that noted by Niesiolowski (1949) between a *Rhagonyche fulva* male (Coleoptera, Cantharidae) and a *Clytanthus herbsti* female (Coleoptera, Cerambicidae). Grandi (1951) also mentioned cases of males that simply attempt copulation with any object that attracted them.

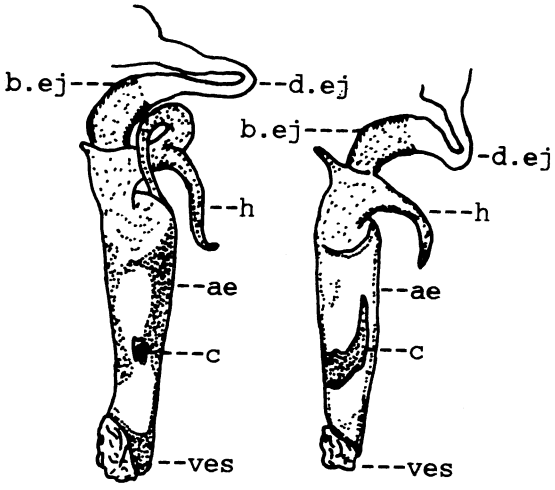


Fig. 3 - Dorsal view of the *ductus ejaculatorius* and *penis*: *Ephestia kühniella* Zell. (left); *Plodia interpunctella* Hb. (right) (from Norris, 1932).
ae = *aedeagus*; b.ej = *bulbus ejaculatorius*; c = *cornutus*; d.ej = *ductus ejaculatorius*; h = horns of the *ductus ejaculatorius*; ves = *vesicula seminalis*.

Reproductive behaviour in most insect species can be subdivided into mate location (the coming together of individuals of opposite sex), courtship and copulation, and oviposition (Alkins, 1980). Grassé (1977) mentioned the emission of aphrodisiac substances by the male once the female is reached. *Drosophila* males emit a scent that induces the females to mating. *Drosophila pseudo-obscura* females do not mate with *Drosophila persimilis* males because of a slight difference in scent. Removing the antennae of the females allows them to mate with either of the two male species (Mayr, 1950).

Lorkovic (1952) provoked the copulatory act between the removed abdomen of a male butterfly and an immobilised female: this artificial method not only has been used

to induce mating between two individuals belonging to the same species (presenting problems for mating under laboratory conditions) but also for interspecific copulations, like the one obtained between certain species of European *Pieris* (for example *Pieris napi* and *Pieris rapae*, the hybrid obtained was called *P. narapae*) and certain species of *Euchloë* (*Euchloë cardamines* with *E. euphenoides*, hybrid: *E. cardaphenoides*) others of *Erebia* and *Hesperia*. As it can be noted despite the occurrence of hybrids, all mating occurred artificially and not naturally as in our case, furthermore the copulating is only interspecific.

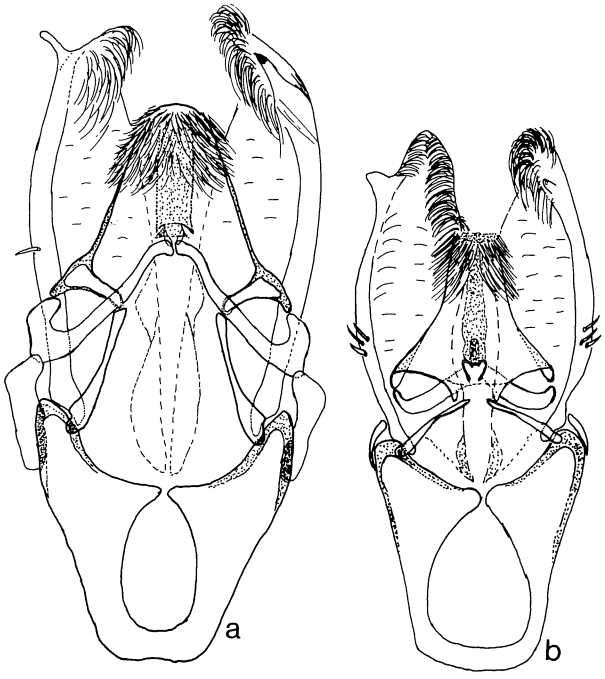


Fig. 4 - Ventral view of male genitalia of *Ephestia kühniella* Zell. (a); *Plodia interpunctella* Hb. (b). The left valva is opened to show the tooth on the costa near its apex. The aedeagus is omitted. The drawings are on the same scale.

Richard & Thomson (1932) in defining the genus *Ephestia* mentioned that it was not easy to distinguish it satisfactorily from the most closely genera since these themselves had not been very well defined. Furthermore, Norris (1932) examined thoroughly the female external genitalia of *Ephestia* and *Plodia* and described them together which means they were very similar. Richards and Thomson (1932) in a detailed work on the genera *Ephestia* and *Plodia*, drew a ventral view of the male genitalia of *E. kühniella* and *P. interpunctella*. Nevertheless, it has been thought better to draw them again. As it could be seen by examining the fig. 4, there are some similarities that might explain the mating success. In Norris (1932), however, it is possible to see a dorsal view of the *ductus ejaculatorius* and

penis of *Ephestia kühniella* and *Plodia interpunctella* (fig. 4a, b). In this case the two organs present various dissimilarities such as horns of the *ductus ejaculatorius* while both the *aedeagus* are relatively similar.

Barrer & Hill (1977) give an idea of typical courtship behaviour of *Ephestia cautella*. We didn't observe this behaviour but the last result which corresponds to the typical position of a male: after gripping the terminal abdominal segments of the female with both *valvae* and possibly with his *uncus* the male proceeds to rotate slowly through a further angle of 180° centred on her genitalia. The copulatory position of the insects under study is the one assumed by the couple of *Ephestia cautella* (Barrer & Hill, 1977), the male having his wings folded up under those of the female (figs. 1 and 2). Furthermore in the case studied it could be noticed that the male died without being able to separate from the female, while usually after mating the couple remains a short period stuck then separates spontaneously. But in case the male dies for unknown reasons the couple is unable to separate (personal observations on three couples of *Plodia interpunctella:* the male died, the female died later on still stuck to the male). This means it is the male that is responsible for separation from the female after mating.

Besides it seems that even the chemical language of both species is similar: as a matter of fact the sex pheromone complex of the *Plodia* and *Ephestia* females has been shown to be the same (Brady et al., 1971; Kuwahara et al., 1971).

As a conclusion we can say that lots of circumstances influenced the success of this unusual intergeneric mating. What would be interesting to study is if it is possible to induce this mating again either in a pseudo-natural way using chemical pheromones or not, or using the artificial method described by Lorkovic (1952).

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REFERENCES

ALKINS M.D., 1980 - Introduction to Insect Behavior. - Macmillan Publishing Company, Inc. New York: 1-236.

BARRER P.M. , HILL R.J., 1977 - Some aspect of the Courtship Behaviour of *Ephestia cautella* (Walker) (Lepidoptera: Phycitidae). - J. Aust. Ent. Soc. 16: 301-312.

BRADY U.E., TUMLINSON J.H., BOWNLEE R.G., SILVERSTEIN R.M., 1971 - Sex stimulant and attractant in the Indian meal moth and in the Almond moth. - Science 171: 802-4.

GRANDI G., 1951 - Introduzione allo studio dell'Entomologia. vol. 1. - Edizioni Agricole, Bologna: 1-950 (p. 281).

GRASSÉ, P.P., 1977. L'accouplement et l'insémination. In: GRASSÉ P.P., Traité de Zoologie. Anatomie, Systématique, Biologie: Insectes: Gamétogénéses, Fécondation, Métamorphoses. T. VIII (V-A). - Masson, Paris: 1-680 (p. 332).

KUWAHARA Y., KITAMURA C., TAKAHASHI S., HARA H., ISHII S. , FUKAMI H., 1971 - Sex Pheromones of the Almond moth and the Indian meal moth. - Science 171: 801-2.

LORKOVIC Z., 1951 - L'accouplement artificiel chez les lépidoptères et son application dans les recherches sur la fonction de l'appareil génital des insectes. - Physiol. Comp., The Hague 3: 313-320.

MAYR E., 1950 - The role of the antennae in the mating behavior of female *Drosophila*. - Evolution 4: 149-154.

NIESIOLOWSKI W., 1949 - Un cas de copulation entre les représentants de deux familles distintes de Coléoptères. (In Polish with French summary). - Polskie Pismo Ent. 18: 221-224.

NORRIS M.J., 1932 - Contributions towards the study of insect fertility. I. The structure and operation of the reproductive organs of the genera *Ephestia* and *Plodia* (Lepidoptera, Phycitidae). - Proc. zool. Soc. London: 595-611.

RICHARDS O.W., THOMSON W.S., 1932 - A contribution to the study of the genera *Ephestia,* Gn. (including *Strymax*, Dyar), and *Plodia*, Gn. (Lepidoptera, Phycitidae) with notes on parasites of the larvae. - Trans. ent. Soc. London 80: 169-250.

ROEDER K.D., 1935 - An experimental analysis of the sexual behaviour of the praying mantid (*Mantis religiosa* L.). - Woods hole 69: 203-220.

ROEDER K.D., TOZIAN L. , WEIANT E.A., 1960 - Endogenous nerve activity and behaviour in the Mantis and the Cockroach. - J. Ins. Physiol. 4: 45-62.

WILDE De J., 1964 - Reproduction. In: ROCKSTEIN M., The Physiology of Insecta, vol 1. - Academic Press, N.Y.: 9-58.

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