

## Gynandromorphic individuals of *Neodiprion sertifer* (Hymenoptera, Diprionidae)

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Heliövaara, K., Väisänen, R., Varama, M. & Viitasaari, M. 1992: Gynandromorphic individuals of *Neodiprion sertifer* (Hymenoptera, Diprionidae). — Entomol. Fennica 3:149–153.

Six gynandromorphic individuals of *Neodiprion sertifer* (Geoffrey) are described from Finland. They were bilaterally gynandromorphic, mosaic-like gynandromorphic or only showed such characters in their head or abdomen.

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### 1. Introduction

The haplo-diploid mode of sex-determination is common in the Hymenoptera. Fertilized eggs having a double set of chromosomes become females, and unfertilized eggs having a single set of chromosomes become males in arrhenotokous species. *Gilpinia hercyniae* (Hartig) is thelytokous and represents one exception to this rule in Diprionidae: fertilized diploid individuals will become males and unfertilized haploid individuals will become females (Reeks 1941).

In insects, the sex of an individual is determined by the genotype of each cell in contrast to vertebrates in which hormones play a major role. Sometimes characters typical of both males and females appear in the same individual, confusing sex determination. Gynandromorphic individuals have certain parts of the body of female genotype and phenotype, while other regions are of male genotype and phenotype. Nilsson (1987) has discussed possible causes of gynandromorphism in

haplo-diploid insects, especially in Hymenoptera Aculeata.

Gynandromorphic individuals have been described from many groups of insects, including Diprionidae (e.g. Britton & Zappe 1918, Coppel 1959, Niklas 1962, Mertins & Coppel 1971, Nuorteva & Kontuniemi 1971, Coppel et al. 1974). In this article, we describe six Finnish gynandromorphic individuals of the European pine sawfly *Neodiprion sertifer* (Geoffrey), of which no gynandromorphic individuals have been reported previously.

### 2. Descriptions

*Specimen A* (Fig. 1A, 2A)

*Oa:* Kauhajoki, 692:25. Larval rearing 1964, emerged in lab. 1965. M. Varama leg.

In this specimen, the bilateral gynandromorphism is the most conspicuous of the six

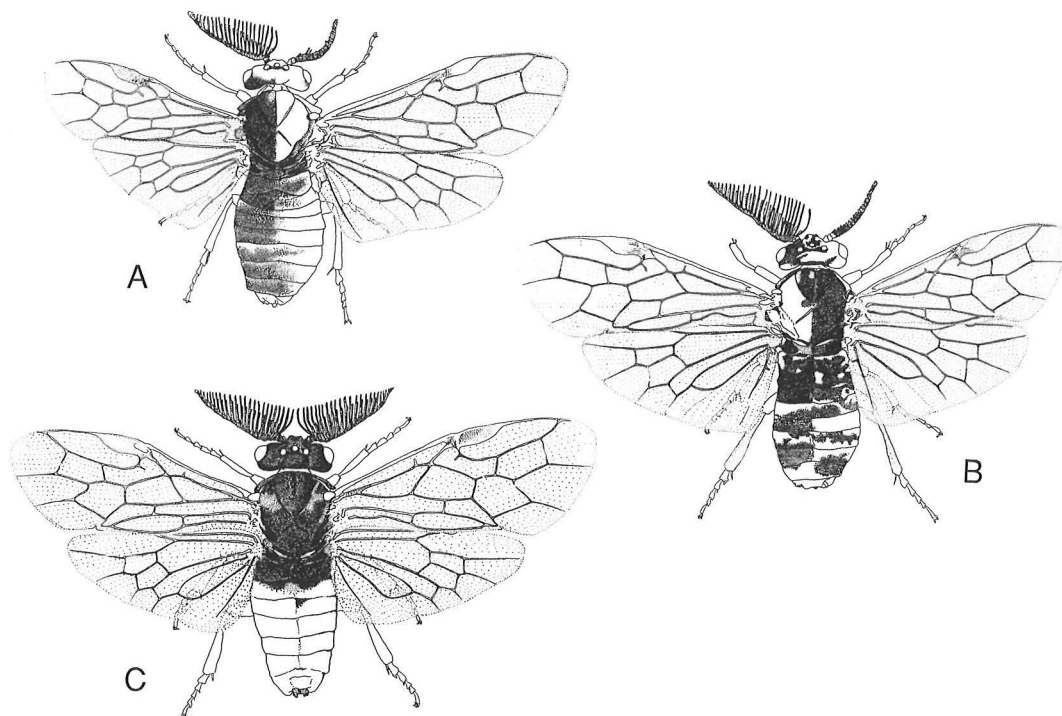


Fig. 1. Gynandromorphic individuals of *Neodiprion sertifer*. Specimens A, B and C in the text, respectively.

ones described. The whole left half of the specimen appears to be almost completely male, and the right half female. The specimen has a female head with a male patch in the left half. The left antenna is male and the right antenna female with some inclination to male in its lamellae.

The left half of the thorax seems to be in principal male, with e.g. anterior part of the scutum with female colour patch. The right half seems to be female. Left legs are male and right legs are female. Also, left wings are male and right wings female.

The left half of the abdomen appears to be male and the right half female. The apex of the abdomen and external genitalia are highly deformed (Fig. 2A). On the right side an isolated valvula 1 grows from a sclerotized surface. Other clearly recognizable parts of the female ovipositor or male genitalia are not present.

#### *Specimen B* (Fig. 1B, 2B)

*St*: Köyliö, 678:25. Rearing: Harjavalta. Emerged in lab. Aug. 1988. K. Heliövaara, E. Kemppi & R. Väisänen leg.

The colour pattern of the head is a mixture of female and male, with the left half more male. The left antenna is male and the right antenna female. The colour of the left anterior part of the head is piceous. This area surrounds left antennal socket and the left hind ocellus.

The left half of the thorax is female in colour and the right half is of the male colour. In the piceous area there are, however, some patches of female colour. The left wings appear to be female and the right wings male. Left legs are female and right legs are male. At least left front legs and hind legs are female and their right counterparts are male (left front tarsus missing).

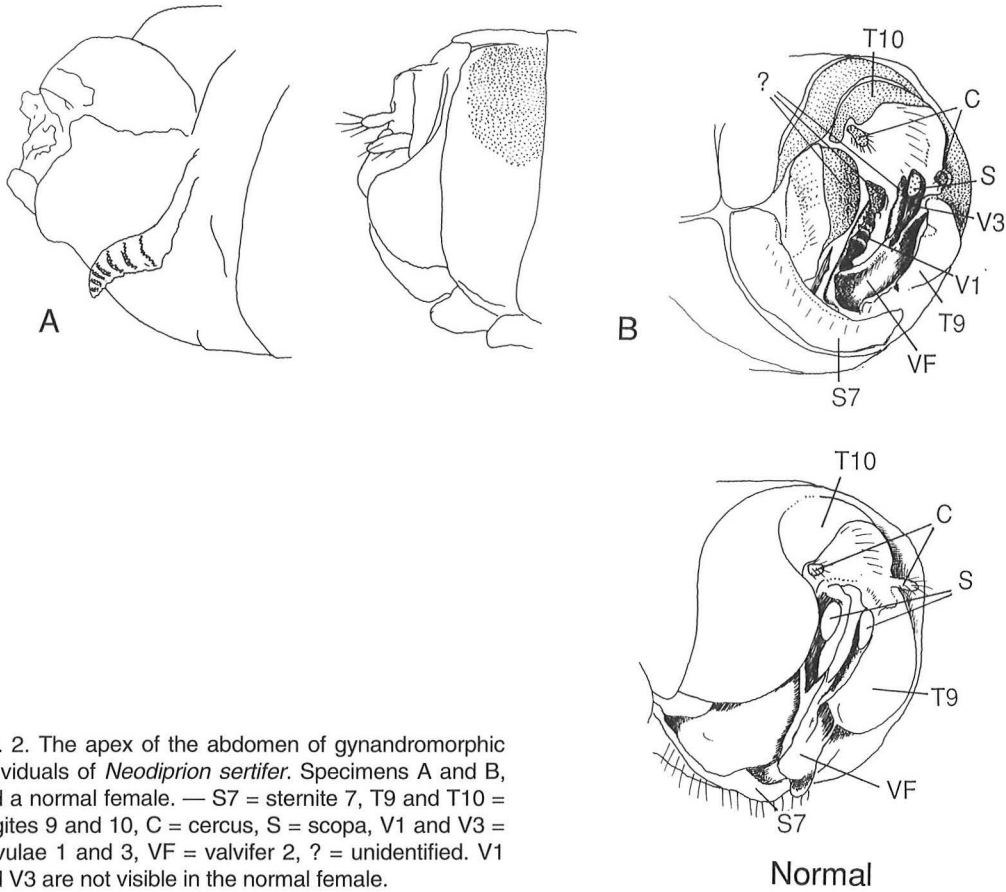


Fig. 2. The apex of the abdomen of gynandromorphic individuals of *Neodiprion sertifer*. Specimens A and B, and a normal female. — S7 = sternite 7, T9 and T10 = tergites 9 and 10, C = cercus, S = scopa, V1 and V3 = valvulae 1 and 3, VF = valvifer 2, ? = unidentified. V1 and V3 are not visible in the normal female.

This sexual dimorphism is inconspicuous in the middle legs.

The abdomen is a mosaic, but the apical part with external genitalia are better developed than those of specimen A. Fig. 2B gives a lateral view of the right side of the apex and a postero-lateral view of the left side. It shows that the apex of the abdomen consists mainly of female components, better developed on the right side. Compared to a normal female abdomen the right side of specimen B shows a slightly modified valvifer 2 and valvula 3. Tergite 9 is also deformed. The right valvula 1 is almost completely developed. No components of male genital capsule were recognized.

*Specimen C* (Fig. 1C)

*St*: Köyliö, Ullanristi, 678:25, Sv 318, caught in a Lund-I pheromone sticky trap (for the trap type, see Anderbrant et al. 1989) 31.8.1990. M. Varama leg.

The specimen appears to be antero-posteriorly divided into male and female halves. The head and antennae are male.

The dorsal part of the thorax is in principal male with some pale patches, which are likely to be female. Wings and legs seem to be female.

The abdomen appears to be normal female, but the saw has not been studied in detail.

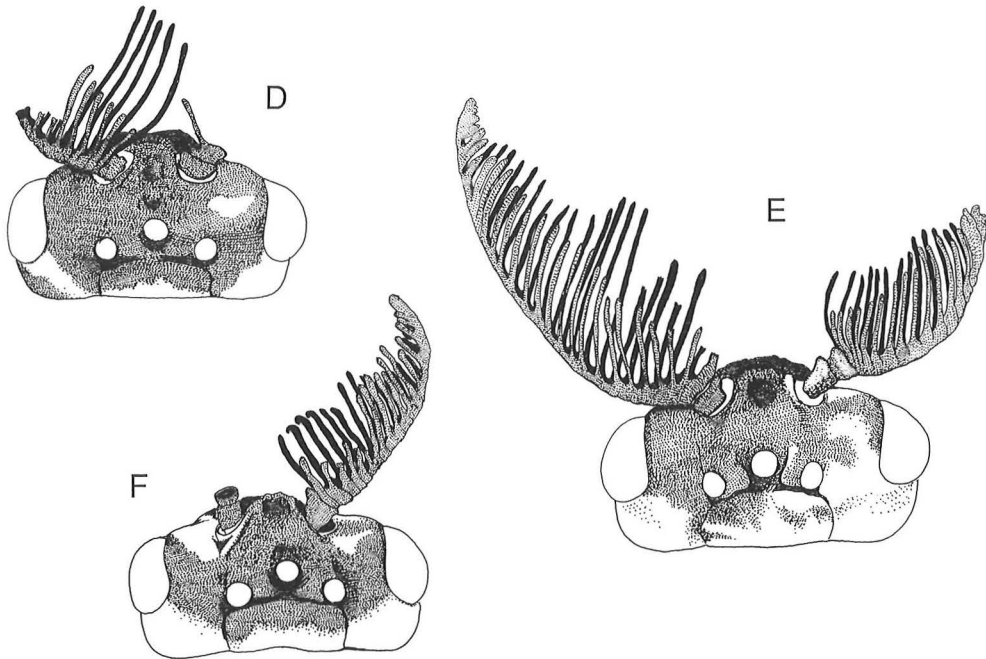


Fig. 3. Heads of gynandromorphic individuals of *Neodiprion sertifer*. Specimens D, E and F in the text, respectively.

*Specimen D* (Fig. 3D: Head)

*Ab*: Suomensjärvi, 670:31. Cocoon found on pine twig 25–26.7.1978. Emerged outdoors 28.8.1978. M. Varama leg.

The head appears in principal to be male (antennae broken) with some female characteristics. Hind part of the vertex is female and a stripe from the compound eye through the left part of vertical area, as well as the right hind corner of the head covering the upper half of the temple, seem to be female. The vertex is short as in males.

Thorax, wings and abdomen are female.

*Specimen E* (Fig. 3E: Head)

*St*: Köyliö, Ullanristi, 678:25, Sv 318, caught in a Lund-I pheromone sticky trap 30.8–13.9.1989. M. Varama leg.

The left antenna is male (some lamellae broken). In the right antenna, the form of the two basal segments are female and their colour almost female. The flagellum is short with rudimentary male characters. The vertex is slightly

asymmetric but long as in females. The left half of the head is more male than the right half.

Thorax, wings and abdomen are female. Legs are partly missing.

*Specimen F* (Fig. 3F: Head)

*Oa*: Alavus, Rantatöysä, 695:32, caught in a Lund-I pheromone sticky trap 16–30.8.1989, M. Varama leg.

The flagellum of the left antenna is missing. The basal segment is rather long, resembling that of female, but piceous as in males. The base of the right antenna is rather long as in females, but piceous. The flagellum is short with rudimentary male characters. The vertex of the head is rather long as in females.

Thorax, wings and abdomen are female.

### 3. Discussion

Haplo-diploid gynandromorphic sawflies are very rarely observed. However, Mertins & Coppel (1971) reported that as much as 0.1% of the

*Diprion simile* (Hartig) adults reared exhibited some degree of sexual admixture. Although *Neodiprion sertifer* has been the subject of numerous investigations due to its pest status, such sex-intergrades have not been reported. It seems evident that the proportion of gynandromorphs is very low in this species.

The female and male parts of a gynandromorph may be distributed in numerous ways, the individuals being widely different. Sometimes it may be difficult to distinguish gynandromorphs from other malformations (cf. Baker & Atwood 1969, Coppel et al. 1974). The *N. sertifer* specimens were bilaterally gynandromorphic, mosaic-like gynandromorphic or only showed such characters in their head or abdomen. Some parts of the gynandromorphic individuals appear to be intermediates between male and female (e.g. some abdominal tergites and parts of head and thorax). Nilsson (1987) suggested that the intermediate characters would be an occurrence of micro-mosaics with male and female cells more or less intermixed and the participation of some growth-promoting substance(s). The apex of abdomen in gynandromorphic *N. sertifer* included parts of the female ovipositor and male genitalia. However, several parts were difficult to homologize and were seemingly deformed.

The sexual behaviour of gynandromorphic sawflies may be conflicting (Peacock 1925, Mertins & Coppel 1971). Three of the gynandromorphic *N. sertifer* individuals were caught by the Lund-1 pheromone traps baited with female pheromone. One of the pheromone traps attracted 1196 males, 62 females and one gynandromorph during the swarming period at Köyliö in 1989. Next year, after controlling the sawflies with a virus preparate, the same trap attracted 291 males, only one female and one gynandromorph (unpubl. data). Since the attracted sawflies not only need to approach the attractant source but also have to enter the opening between the cardboard sheets, only truly responsive individuals are caught by this type of trap (Anderbrant et al. 1989). The

present results show that the gynandromorphic individuals were capable of flight, and that they were attracted by the female pheromone.

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Received 24.VI.1991