SHORT PAPER

Hexaploid and decaploid races of the parthenogenetic Japanese weevil *Catapionus gracilicornis* Roelofs (Coleoptera: Curculionidae)

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ABSTRACT

The chromosomes of the Japanese weevil, *Catapionus gracilicornis* Roelofs have been investigated in Aomori Prefecture. Both hexaploid ($6x=63$) and decaploid ($10x=100$) parthenogenetic races were found in Temma. The species is now known to have six parthenogenetic races, $2x$, $3x$, $4x$, $5x$, $6x$, and $10x$, as well as a diploid bisexual race. It was shown that pentaploid forms arose from hexaploid forms as I stated in 1980.

In my former papers I reported that the Japanese weevil species *Catapionus gracilicornis* Roelofs had four cytologically distinct parthenogenetic races as well as a diploid bisexual race ($2n=22$). The parthenogenetic races are a diploid with 22 chromosomes, a triploid with 33 chromosomes, a tetraploid with 44 chromosomes and a pentaploid with 55 chromosomes. Tetraploid and pentaploid races coexist in Aomori, Akita and Iwate Prefectures, situated in the northern part of Japan (Takenouchi 1966, 1970, 1976a, 1980a, 1982a). I have continued a cytological survey of this species in Aomori Prefecture and have found two additional parthenogenetic races of this species with different chromosome numbers. They represent higher degrees of polyploidy than the ones that have been reported thus far. This paper reports the details.

136 females of *Catapionus gracilicornis* were collected in Temma, Aomori Prefecture, on May 28, 1981. Their chromosomes were checked in early cleavage metaphase in squash preparation as usual (Takenouchi, *et al.* 1981). The chromosome count succeeded in 58 females: 31 were tetraploid (53.4%), 26 pentaploid (44.8%), and a single hexaploid (1.7%). The hexaploid specimen gave rise to 3 embryos having more than 60 chromosomes, respectively, and a single embryo with 55 chromosomes. The former embryos were hexaploid and the last embryo undoubtedly a pentaploid. This fact shows that the pentaploid animal was derived from the hexaploid as I stated earlier (Takenouchi 1980). The appearance of the pentaploid individual among the offspring

Figs. 1-3. Chromosomes of the embryos of *Catapionus gracilicornis*. 1. Hexaploid ($6x=64$). 2. Pentaploid ($5x=55$). 3. Decaploid ($10x=110$).

of a hexaploid can be explained by a separation and subsequent elimination of one haploid chromosome set at the single maturation division metaphase of a hexaploid individual. The best cell of the hexaploid embryo is shown in Fig. 1, and a pentaploid cell in Fig. 2.

165 females of *Catapionus gracilicornis* were collected in the same place in Temma, on May 25, 1982. The chromosome examination showed that 32 were tetraploid and 40 were pentaploid. In addition a single decaploid female was found. She provided 3 decaploid embryos with 110 chromosomes (Fig. 3).

The highest level of ploidy recorded until now was hexaploidy in two Japanese species: *Blosyrus japonicus* Sharp in Rishiri Island, and *Callirhopalus obesus* Roelofs from Takinoue (Takenouchi 1976b). The present study showed an additional hexaploid race in *Catapionus gracilicornis* in Temma. Therefore, a total number of hexaploid parthenogenetic species is now three.

The present study reveals that the new highest level of polyploidy in the

Curculionidae is the decaploid race in *Catapionus gracilicornis* in Temma. The decaploid chromosome number (110 chromosomes) is also the highest chromosome number in the weevils. Even though polyploidy is in animals encountered in connection with parthenogenesis, so high degree of polyploidy has been found in parthenogenetic animals only in the brine shrimp *Artemia salina* (Hass and Goldschmidt 1946). According to my experiment, hexaploid curculionids arisen from the triploid by a doubling of the chromosome number probably in the first cleavage division and octaploid animals from tetraploid and decaploid forms from pentaploid forms (Takenouchi 1980, 1982; Takenouchi *et al.* 1981). A most interesting observation is the occurrence of different degrees of polyploidy at Tomma, Aomori Prefecture. There were tetraploid and pentaploid as well as single hexa- and decaploid individuals. This observation supports the view that they would have arisen in the way presented above.

The total number of cytologically investigated parthenogenetic races and species is now 74 and these forms are as follows: 4 are diploid, 42 triploid, 18 tetraploid, 6 pentaploid, 3 hexaploid, 1 octaploid and 1 decaploid (Lokki and Saura 1979; Takenouchi 1980, 1981 a, b, 1982a-c).

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REFERENCES

- HAAS, G. and GOLDSCHMIDT, E. (1946) A decaploid strain of *Artemia salina*, *Nature* **158**, 239.
- LOKKI, J. and SAURA, A. (1980) Polyploidy in insect evolution. In *Polyplody. Biological Relevance*, (ed. W. H. Lewis), pp. 277-312. Plenum Press, New York and London.
- TAKENOUCHI, Y. (1966) Tetraploid and pentaploid races of the Japanese parthenogenetic weevil, *Catapionus gracilicornis* Roelofs (Curculionidae: Coleoptera). *Annot. Zool. Japon.* **39**, 47-54.
- TAKENOUCHI, Y. (1970) A further chromosome study in bisexual and parthenogenetic races of the weevil, *Catapionus gracilicornis* Roelofs (Curculionidae: Coleoptera). *Jpn. J. Genet.* **45**, 457-466.
- TAKENOUCHI, Y. (1976) A study on the chromosomal dimorphism in *Catapionus gracilicornis* Roelofs (Curculionidae: Coleoptera). *Jpn. J. Genet.* **51**, 279-283.
- TAKENOUCHI, Y. (1976b) A study of polyploidy in races of Japanese weevils (Coleoptera: Curculionidae). *Genetica* **46**, 327-334.
- TAKENOUCHI, Y. (1980a) A diploid parthenogenetic race of the weevil species *Catapionus gracilicornis* from Japan (Coleoptera: Curculionidae). *Entomol. General.* **6**, 367-369.
- TAKENOUCHI, Y. (1980b) Experimental study on the evolution of parthenogenetic weevils (Coleoptera: Curculionidae). *J. Hokkaido Univ. Educ. Section II B* **31**, 1-12.
- TAKENOUCHI, Y. (1981a) A chromosome study on two new polyploid weevils in Kyûshû, Japan. *Genetica* **55**, 137-139.
- TAKENOUCHI, Y. (1981b) A further chromosome study on a parthenogenetic weevil *Callirhopalus bifasciatus* Roelofs (Coleoptera: Curculionidae). *Genetica* **55**, 141-145.
- TAKENOUCHI, Y. (1982a) A triploid race of the reportedly parthenogenetic Japanese weevil *Catapionus gracilicornis* Roelofs (Coleoptera: Curculionidae). *Jpn. J. Genet.* **57**, 185-187.

- TAKENOUCHI, Y. (1982b) A tetraploid race of the reportedly parthenogenetic Japanese weevil *Scepticus insularis* Roelofs (Curculionidae, Coleoptera). *Kontyû* **50**, 500-501.
- TAKENOUCHI, Y. (1982c) Chromosomes of new parthenogenetic races of *Callirhopalus bifasciatus* Roelofs and *Callirhopalus obesus* Roelofs (Curculionidae: Coleoptera). *J. Hokkaido Univ. Educ. Section II* **33**, 1-5.
- TAKENOUCHI, Y., OKAMOTO, H. and SUGAWARA, H. (1981) A study on the influence of low temperatures on the eggs of the tetraploid parthenogenetic *Catapionus gracilicornis* Roelofs (Curculionidae: Coleoptera). *J. Hokkaido Univ. Educ. Section II B* **32**, 1-15.