

KARYOTYPE OF THE EGG CHROMOSOMES OF *ARGIOPE LUZONA* (WALCK.), AN ORB-WEAVING SPIDER (ARANEAE, ARANEIDAE)

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ABSTRACT

The egg chromosomes of *Argiope luzona* (Walck.) revealed distinct karyotypic features. Somatic chromosome number is $2n=24$. Chromosomes are all monocentric and are either median, submedian or subterminal. Relative lengths of chromosomes range from 0.040 to 0.014, Mitotic division is regular and normal with a mean mitotic index of 85.6%. Interphase cells contain round nuclei with diameter ranging from 14.12 to 21.18 microns. In the prophase cells the nuclei are oval to round but most are oval with dimensions ranging from 31.77 to 35.30 microns. Metaphase chromosomes align their centromeres at the equatorial region. Disjunction of sister chromatids occur at anaphase and assemble themselves at polar ends of the cell at telophase.

Key Words: *Argiope luzona* (Walck.), egg chromosomes, karyotype.

INTRODUCTION

Spiders play an important role in regulating geometric increases of insect and other arthropod pests in various agroecosystems. Despite their recognized economic importance chromosome studies on Philippine spiders as well as literature about them are scarce or limited to a few species only.

The Philippine spider fauna consist of more than 3,000 species. In Mt. Makiling alone, there probably are hundreds of spiders many of which are still to be discovered. One of the most common is an orb-weaving species. *Argiope luzona* (Walck.) (Fig. 1).

This study presents the karyotypic studies made on the egg chromosomes of *Argiope luzona*.

MATERIALS AND METHODS

Collection and rearing of specimens. Females of *A. luzona* were caught by net sweeping and vial tapping from their orb webs at different areas of Mt. Makiling. The specimens were brought to the laboratory live and placed individually in bottles to allow them to lay eggs. *Drosophila* flies were provided as prey.

Cytological preparation and analysis. An egg mass was placed on a spot plate and two drops of Ringer's solution (NaCl, 0.65g; KCl, 0.025g; CaCl, 0.03g; and distilled water, 100 ml) were added. With a stirring rod, the eggs were squashed until all the chorions were removed. The squashed eggs were then fixed with Carnoy's solution (1 part methanol: 3 parts glacial acetic acid.)

The fixed egg material on the glass slide was then stained with a drop of lacto-aceto-orcein. After staining, a clean cover glass was placed over the material and pressed with the thumb and eraser end of an unused pencil. To destain overstained cells 45% acetic acid was used. The edges of the cover glass were paraffin-sealed to prevent the material from drying-up.

Karyotypic analysis of the prepared egg material was done using a light microscope. The cells and chromosomes were examined and data were taken on the following: diploid number of premetaphase chromosomes; relative lengths of chromosomes; number of centromeres and arm ratio; number of cells dividing and mitotic index; and changes occurring during the different stages of mitosis.

The relative lengths of the chromosomes were determined using the formula,

$$\text{Relative length} = \frac{\text{Length of each chromosome pair}}{\text{Total length of chromosomes}}$$

The arm ratio was computed using the formula.

$$\text{Arm ratio} = \frac{\text{Length of long arm}}{\text{Length of short arm}}$$

Based on the arm ratios, the chromosomes were classified according to Levan et. al., (1969).

The mitotic index was computed using the formula,

$$\text{Mitotic index} = \frac{\text{Number of dividing cells}}{\text{Total number of cells observed}}$$

Photomicrographs of each mitotic stage were taken under an oil immersion objective of a photomicroscope and the karyogram of the chromosomes was constructed.

RESULTS AND DISCUSSION

Prior to active cell division or mitosis, non-dividing egg cells or zygotes of *A. luzona* exhibited circular and compact nucleus with intact membranes (Fig. 2a). The nuclear diameter range from 14.12 to 21.18 microns. The successive mitotic division of the egg cells are regular and normal.

The egg nuclei are either circular or oval. At early prophase stages (Figs. 2b and 2c) notable increases in egg nuclei diameter were observed. Their diameter range from 31.77 to 35.30 microns. At later prophase stages (Figs. 2d - h), the chromatin material became distinctly visible as long threadlike strands due to contraction and condensation.

The chromosomes are at their maximum contracted state during early metaphase or prometaphase which was the most ideal stage for determining chromosome number. The diploid chromosome number is $2n=24$. The chromosomes are all monocentric. Karyogram analysis showed that the relative lengths of the chromosomes range from 0.04 to 0.15 mm. The lengths of the long arms range from 4 to 15 mm while the short arms range from 0.5 to 5 mm. The arm ratios range from 1.08 to 8. Following Levan et al. (1969) the chromosomes are classified as median, submedian and subterminal.

At metaphase, the chromosomes align their centromeres at the equatorial region of the nucleus (Fig. 2i). Later, at anaphase, sister chromatids of each chromosome start to separate and move towards opposite poles (Figs. 2j - l). The disjunction of the chromatids is normal and regular. At telophase, two sets of chromosomes start to reorganize themselves into two new daughter nuclei (Figs. 2m - n).

After karyokinesis, cytokinesis follows and ultimately produce two daughter cells which proceed to interphase stage.

The counts on dividing and non-dividing egg cells (Table 1) revealed a mitotic index ranging from 79.2% to 92.7%, with a mean of 85.6%. Such indexes indicate high viability of the egg cells or survival to the spiderling stage.

SUMMARY AND CONCLUSIONS

The interphase and mitotic stages of the egg cells of *A. luzona* are normal and regular. The egg nuclei are either round or oval with the latter shape being dominant. Notable increase in the size of the nuclei occurs from interphase to the prophase stage. The diploid chromosomes number is $2n=24$. Karyograms of the pre-metaphase chromosomes show relative lengths ranging from 0.04 to 0.14. Arm ratios range from 1.6 to 8.0 and the monocentric chromosomes are median, submedian and subterminal. The mean mitotic index is 85.6% indicating high viability of egg cells or survival to the spiderling stage.

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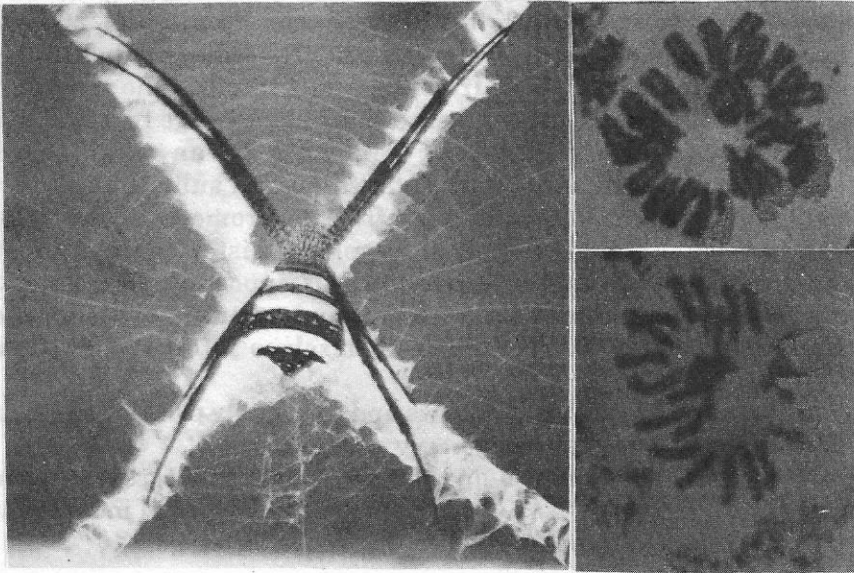


Figure 1. Adult female orb-weaver, *Argiope luzona* (Walck.) (Right) and its premetaphase chromosomes ($2n=24$) (Left), magnification, 1000 x (oil immersion).

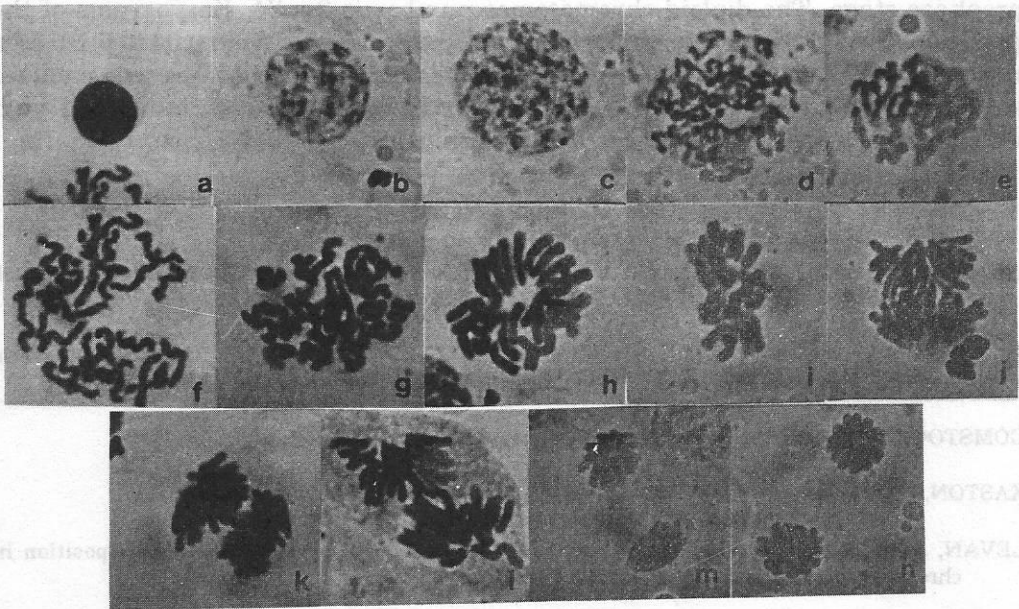


Figure 2. Interphase (a) and stages of mitosis in orb-weaver, *Argiope luzona* (Walck.). b-e, prophase; f-h, premetaphase; i, metaphase; j-l, anaphase; and m-n, telophase. Magnification, 1000 x (oil immersion)

Table 1. Mitotic indices of the orb weaver, *Argiope luzona* (Walck.)

SPIDER	Egg Cells (no.)	Dividing Cells (no.)	Mitotic Index (%)
1	63	50	79.4
2	38	35	92.1
3	35	29	82.9
4	55	51	92.7
5	57	45	78.9
6	24	19	79.2
7	33	30	90.9
8	34	30	88.2
9	49	41	83.7
10	60	53	88.3
MEAN	44.8	38.3	85.6