Contributions to the characterization of *Vavilovia formosa* (syn. *Pisum formosum)*. II. Morphology of androecium and gynoecium and mitosis

Atlagic, J.[1], Mikic, A.[1], institute of Field and Vegetable Crops, Novi Sad, Serbia
Sarukhanyan, N.[2], Vanyan, A.[2], [2]Green Lane Agricultural Assistance NGO, Yerevan, Armenia
Akopian, J.[3], Gabrielyan, I.[3], [3]National Academy of Sciences, Institute of Botany, Yerevan, Armenia
Smykal, P.[4], Kenicer, G.[5], [4]Agritec Plant Research Ltd., Sumperk, Czech Republic
Vishnyakova, M.[6] and [5]Royal Botanical Garden Edinburgh, Edinburgh, UK
Ambrose, M.[7] [6]N. I. Vavilov Institute of Plant Industry, St. Petersburg, Russia
[7]John Innes Centre, Norwich, UK

Vavilovia *(Vavilovia formosa* Stev. Fed., syn. *Pisum formosum)* is the only species of the genus *Vavilovia* Fed. included in the tribe *Fabeae* with vetchling *(Lathyrus* L.), lentil *(Lens* Mill.), pea *(Pisum* L.), and vetch *(Vicia* L.) (1). Largely ignored for decades, *V. formosa* has become the object of recent attention by geneticists and molecular taxonomists (2) due to its specific position within the tribe and the supposed role in its evolution (3).

The flowers of *V. formosa* are often solitary, axillary and pedunculate, with small and/or inconspicuous bracts, lacking bracteoles, and having a campanulate calyx. The corolla of *V. formosa* is pink or purple with an oblong standard, falcate to oblong wing and blant, non-cristate and sometimes white keel (4).

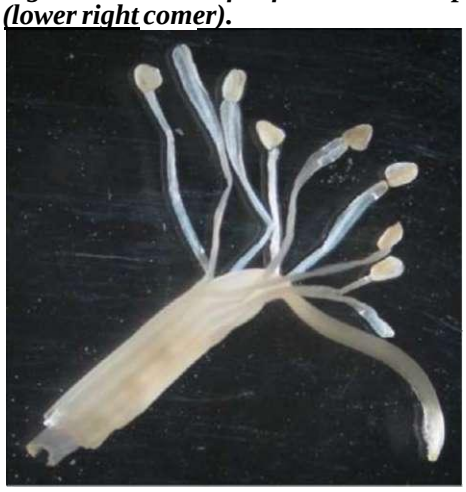
This preliminary research was aimed at examining the morphology of the reproductive organs of *V. formosa* with emphasis on the androecium and gynoecium, as well as understand some basic cytogenetics of the species.

Materials and Methods

The first of the three expeditions aimed at *in situ* research and *ex situ* conservation of *V. formosa* in Armenia was carried out to the Mount Ughtasar in southern Armenia, on July 17, 2009 (5). During this expedition, samples of stems, leaves and flowers of one population growing at an altitude of between 3305 and 3315 masl were collected and fixed in Carnoy I, a 3:1 solution of ethanol and glacial acetic acid.

The parts of *V. formosa* flowers were observed using stereo microscope Stereo microscope Stemi 2000 (Carl Zeiss, Gottingen, Germany) and photographed by the Power Shot G5 Digital Camera (Canon, Japan). The pollen grains were removed from the anthers and their viability was determined using the staining method of Alexander (6). The youngest leaves from the fixed material were used to determine the chromosome number using the acetocarmine method (7).

Figure I. Stamens of V. formosa en velopingpistil (lower right comer).



Results and Discussion

Androecium. As in many other legume species, the androecium in *V. formosa* is diadelphous, where nine filaments are fused together and anthers are spherical and two-pieced (Fig. 1). In some fully developed flowers only one or two filaments had anthers. In the case of fully developed flowers with regular

Figure 2. Two fertile and one sterile pollen grains of V. formosa.

size and color this could be an indicator that, for unknown reasons, *V. formosa* produces less pollen and; therefore, fewer seeds. The pollen grains of *V. formosa* are ellipsoid-shaped with a thin exine and one pore. The fertile pollen grains are larger than those that are sterile which are often deformed (Fig. 2). On average, the viability of the *Vformosa* pollen grains was 93.3%.

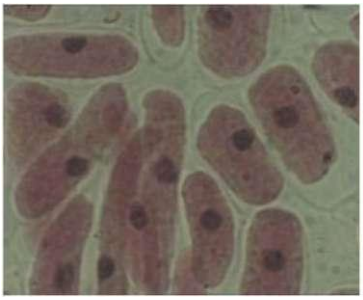
Figure 3. A V. formosa pistil

Gynoecium The ovary in *V. formosa* is protected by the merged calyx. It has a horizontal position while the style and the feather-shaped and hairy stigma have a vertical position that follows the position of a flower (Fig. 3). The ovary usually contains 7 or 8 spherical ovules (Fig. 4), which is more than the 3 to 5 seeds produced from a typical pod (8).

Figure 4. A dissected V. formosa ovary with 7 ovules

Mitosis. A large majority of the *V. formosa* cells in the acetocarmine preparations were in interphase (Fig. 5a). Several cells were in metaphase (Fig. 5b) and in anaphase (Fig. 5c), demonstrating that the *V. formosa* somatic cells contain 14 chromosomes as determined earlier by rather rare cytogenetic research on this species (9).

Figure 5. Mitosis in V. formosa: (a) interphase;



(b) metaphase;

(c) anaphase.

Conclusions

The obtained results of this preliminary research will hopefully encourage further investigations of the flower apparatus of *V. formosa,* thus contributing to both its more detailed taxonomical description and determining its mating system that may prove helpful for its *in situ* and *ex situ* conservation.

Acknowledgements

This work was financially supported by the Ministry of Science and Technological Development, Republic of Serbia, Grants No. and 20090 and 31024.

The authors are grateful to Darko Znaor, Zvonimir Bede and Dusan Dozet for their assistance.

References

1. Kenicer, G.J., Smykal, P., Visnhakova, M. and Mikic, A. 2009. Grain Legumes 51: 8.
2. Smykal, P., Kenicer, G.J. and Mikic, A. 2009. Book of Abstracts of the IV Congress of the Serbian Genetic Society, Tara, Serbia, 1-5 June 2009, p. 166.
3. Mikic, A., Smykal, P., Kenicer, G., Vishnyakova, M., Akopian, J., Sarukhanyan, N., Gabrielyan, I., Vanyan, A., Toker, C., Cupina, B., Ambrose, M., Mihailovic, V. and Ellis, N. 2009. Pisum Genetics 41: 34-39.
4. Mikic, A., Smykal, P., Kenicer, G., Sarukhanyan, N., Akopian, J., Gabrielyan, I., Vanyan, A., Sinjushin, A., Demidenko, N., Cupina, B., Mihailovic, V., Vishnyakova, M. and Ambrose, M. 2010. Field and Vegetable Crops Research 47: 387-394.
5. Akopian, J., Sarukhanyan, N., Gabrielyan, I., Vanyan, A., Mikic, A., Smykal, P., Kenicer, G., Vishnyakova, M., Sinjushin, A., Demidenko, N. and Ambrose, M. 2010. Genetic Resources and Crop Evolution 57: 1127-1134.
6. Alexander, M.P. 1969. Stain Technology 11 (3): 117-123.
7. Mezei, S. 1985. Journal for Scientific Agricultural Research 46 (164): 387-402.
8. Davies, P. H. 1970. In: Flora of Turkey and East Aegean Islands 3, Edinburgh, UK, 44-45.
9. Abramova, L. I. 1971. Bulletin for Applied Botany, Genetics and Plant Breeding 45 (3):240-243.