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The Research of Ecological Nutritional Organs of Invasive Plants Structural Characteristics

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Abstract [**Objective**] The aim of this paper was to discuss the adaptability of ecological nutritional organs of invasive plants. [**Method**] By dint of high-definition display of plant tissue crystal method and paraffin section method, the vegetative organs root, stem and leaf cross-section of the organizational structure of Asteraceae *Ambrosia trifida* L. ragweed (*Ambrosia trifida* L.) in the suburbs of Changchun City in Jilin Province were inspected. [**Result**] The structural basis for ecological invasive plant *Ambrosia trifida* L. vegetative organs was mainly through strengthening the roots of water absorption and transporting function, increasing the water storage function of leaf and stem, reducing the water absorption of stem and leaf for plants to promote water absorption and to enhance the assimilation of leaves to achieve a variety of complex environmental conditions in the rapid growth and development in order to achieve an ecological invasion. [**Conclusion**] The study provided reference for the biological fundamental research of *Ambrosia trifida* L.

Key words *Ambrosia trifida* L. (*Ambrosia trifida* L.); Crystal; Ecological invasion, Structural basis

Ecological nutritional organs of invasive plants have pretty well adaptability to all kinds of complicated environment, and can quickly survive and propagate from the environment that other plant can not endure. It can also result into the transition of ecosystem structure having advantage in plants competition. Ecological invasive plants usually has negative influences on agricultural production and can easily break the current ecological balance state, which have certain bad effects on animals and human beings. The purpose of nutritional organ structure of ecological invasive plants is to discuss the structure mechanism of ecological invasive plants adapting to various complicated environment and having advantages in competition with other plants, through observation of ecological invasive plants microscopic structure. The positive roles were discussed of plants ecological invasive structure adaptability mechanism in real production to the prevention and deduction of large scale of weeds and ecological environment protection in China. *Ambrosia trifida* L. originates from America and Mexican. It has been widely distributed. Because it has such strong adaptability that normal weed has difficulty in controlling its survival and propagation, it has become important target plant for preventing weeds[1]. The study of *Ambrosia trifida* L. in China was mainly about risk analysis, group or cluster distribution and prevention[2-4]. The basic study about the ecological invasive biology was insufficient. Therefore, based on the basic rule that structure is the foundation of function, by dint of high-definition display of plant tissue crystal method and paraffin section method, the vegetative organs root, stem and leaf cross-section of the organizational structure of Asteraceae *Ambrosia trifida* L. ragweed (*Ambrosia trifida* L.) in the suburbs of Changchun City in Jilin Province were inspected, so as to provide reference for the study of the biological fundamental research of *Ambrosia trifida* L.

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Materials and Methods

Materials

Ambrosia trifida L. comes from suburbs of Changchun City in Jilin Province.

Methods

By dint of high-definition display of plant tissue crystal method and paraffin section method, eternal glasses of cross-section of stem and leaves are made and observed under microscope. By dint of Motic digital microscopic film equipment or relevant equipment or Motic Images Plus 2.0 software, microscopic film and digital measure were carried out to glasses symbol under different times.

Results and Analyses

Microscopic structure of root

The root has had secondary structure, which was mainly composed by periderm and secondary vascular tissue. There was no marrow in the bone and primary xylem four prototype. The cork layer of periderm was composed by four to seven cells. The aperture of the tube of secondary vascular tissue was large and sparsely distributed. It was existed in single tube form and sometimes in double tubes. The secondary wood cell was underdeveloped and wood fiber was rich (Fig.2).

Microscopic structure of stem

The stem was composed by surface skin, cortex and vascular cylinder; Outer tangential wall of epidermal cell was thick. The cell was small and tight. The cortex is usually formed by six to eight layers of small cells, which accounted for small percentage in cross-section. The number of vascular bundle was large and tube size was small. It was lined in short tube. The bast fiber developed in bundle around the vascular bundle. The marrow and marrow line was developed and marrow accounted for two third of the stem in stem section. There were many crystal cells in the marrow and medullary ray around vascular bundle (Fig.3, 4).

Microscopic structure of leaves

The leaves were flat and grid structure was developed.

Sponge organization cell gridalized and was close to isobilateral leaf. The hair of surface skin was developed. The chloroplast of grid structure cell was of one layer and distributed evenly around cells; cell chloroplast number and distribution in sponge organization was the same as that in grid organization, only that the cell was short and gap between cells was larger than the former one. The primary vein was made up by two to four vascular tissues. There was basic organization being made up by abundant thin organization cell around vascular tissues of primary vein, and many sparse crystal cells.

Fig. 1 *Ambrosia trifida* L. root (×4)

Fig. 2 *Ambrosia trifida* L. root (×10)

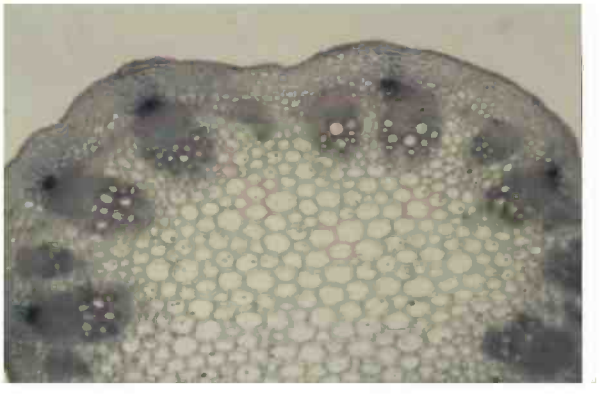

Fig. 3 *Ambrosia trifida* L. stem(×4)

Conclusions and Discussions

The structure corresponding to function is a basic rule of biological sphere. Environment influences the morphology of plants[5]. The nutrition organ of ecological invasive plant is similar to that of plants in harsh environment such as saline and alkaline land and desert. Ecological invasive plant has good adaptability to various complicated environment[6-10]. It can quickly survive and propagate from the environment that other plant can not endure. It can also result into the transition of ecosystem structure having advantage in plants competition. The study of the structure characteristics of nutritional organ of ecological invasive plants had significant importance to the revealing of ecological invasive mechanism of *Ambrosia trifida* L. and effective deduction.

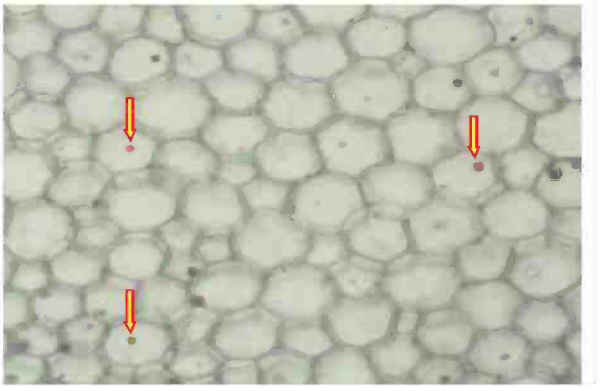

Fig. 4 *Ambrosia trifida* L. stem(×10)

Fig. 5 *Ambrosia trifida* L. leaves (×4)

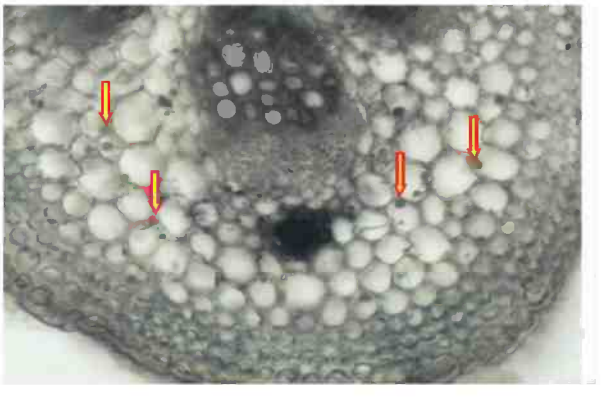

Fig. 6 *Ambrosia trifida* L. leaves (×10)

Fig. 7 *Ambrosia trifida* L. leaves (×40)

Adaptable structure of root

Experiment suggests that the cork layer of root of *Ambrosia trifida* L. is developed. Developed cork layer became the hindrance of plants root and soils, which can effectively

diminish the influence of surrounding soils on the root, which made the root full of moisture and not disperse into the soil solution of low water because of bad environment. The root has large-sized tube, which can ensure the rapid assimilation and transportation of moisture and photosynthetic product. Plants can quickly assimilate moisture and organic nutrition which was beneficial for plants to react rapidly to adverse environment.

Adaptable structure of stem

Experiment suggested that *Ambrosia trifida* L. had developed marrow and medullary ray. The abundant parenchymal tissue had positive effect on the horizontal transportation of moisture and storage. The abundant moisture was the basis of plants growing rapidly in various complicated environment. There were many crystal cells around the vascular bundle of marrow and medullary ray. Crystal cell was the crystallization of high concentration solution. Therefore, the solution with crystal cell had low water potential which could reduce the water in plants, and was conductive to the assimilation of moisture in harsh environment such as saline and alkaline or drought of th elow water potential.

Adaptable structure of leaves

Experiment suggested that nearly all the leaves of *Ambrosia trifida* L. were made up by grid organization cell. Sponge organization cell also showed gridalization tendency in short stick shape. The chloroplast distributed on the wall around the leaf and meet tissue. The above-mentioned characteristics could improve the photosynthesis effect of plants to a level that adapt to the mal-nutrition of plants resulted by harsh environment. Besides, there were abundant parenchymal tissues and crystal cells around vascular bundle of main vein. The existence of abundant crystal cells was conductive to reduce water potential of plants to a level to reinforce plants roots' assimilation of moisture, same the way as stem. The large amount of parenchymal tissues around the vascular bundle of main vein were same as the developed marrow and medullary ray in the stem, which had storage and horizontal transportation moisture function, which was conductive to sufficient moisture supply in plants.

In summary, the structure foundation of ecological invasive plants *Ambrosia trifida* L. was through strengthening roots' moisture assimilation and transportation, improving stems and leaves' moisture preservation and reducing stems and leaves' water potential, so as to facilitate plants absorption of moisture and reinforce leaves assimilation to realize rapid growth in various complicated environment and to effectively realize ecological invasion.

References

[1] WEI SH(魏守辉), QU Z(曲哲), ZHANG CX(张朝贤), *et al.* Invasive alien species giant ragweed (*Ambrosia trifida* L.) and its risk assessment(外来入侵物种三裂叶豚草及其风险分析)[J]. Plant Protection(植物保护), 2006, 32(4): 14-19.

[2] LI JD(李建东), SUN B(孙备), GUO W(郭伟). Spatial distribution pattern of exotic invaded weed *Ambrosia trifida* L. population(三裂叶豚草种群的空间分布)[J]. Hubei Agricultural Sciences(湖北农业科学), 2006, 45(5): 608-610.

[3] DA LJ(达良俊), WANG CX(王晨曦), TIAN ZH(田志慧), *et al.* New distribution pattern of invasive alien species exotic invaded weed *Ambrosia trifida* L. population of Sheshan region in Shanghai(上海佘山地区外来入侵物种三裂叶豚草群落的新分布)[J]. Journal of East China Normal University: Natural Science(华东师范大学学报: 自然科学版), 2008(2): 37-40.

[4] JIN H(金虹). Research advance on biological control of ragweed in China(豚草在我国的生物防治研究进展)[J]. Prataculture & Animal Husbandry(草业与畜牧), 2006(7): 7-10.

[5] WANG XL(王勋陵). Plant morphology and environment(植物形态结构与环境)[M]. Lanzhou: Lanzhou University Press(兰州: 兰州大学出版社), 1981.

[6] WANG H(王虹), DENG YB(邓彦斌), XU XH(许秀珍), *et al.* Anatomical studies on ten Xerophytes and Halophytes in Xinjiang(新疆10种旱生、盐生植物的解剖学研究)[J]. Journal of Xinjiang University: Natural Science Edition(新疆大学学报: 自然科学版), 1998(11): 67-73.

[7] ZHOU LL(周玲玲), FENG YZ(冯元忠), WU L(吴玲), *et al.* Anatomical studies on six Halophytes in Xinjiang(新疆6种盐生植物的解剖学研究)[J]. Journal of Shihezi University: Natural Science(石河子大学学报:自然科学版), 2002, 6(3): 217-221.

[8] DENG YB(邓彦斌), JANG YC(姜彦成), LIU J(刘健). The Xeromorphic and *Saline Morphic* structure of leaves and assimilating branches in ten *Chenopodiacea* species in Xinjiang(新疆10种藜科植物叶片和同化枝的旱生和盐生结构研究)[J]. Chinese Journal of Plant Ecology(植物生态学报), 1998, 22(2): 164-170.

[9] ZHAO KF(赵可夫), FAN H(范海). Halophytes and their habitat to adapt to physiological saline(盐生植物及其对盐渍生境的适应生理)[M]. Beijing: Science Press(北京: 科学出版社), 2005.

[10] JIANAER AH(贾娜尔·阿汗), YANG CW(杨春武), SHI DC(石德成), *et al.* Physiological response of an alkali resistant halophyte kochia sieversiana to salt and alkali stresses(盐生植物碱地肤对盐碱胁迫的生理响应特点)[J]. Acta Botanica Boreali Occidentalia Sinica(西北植物学报), 2007, 27(1): 79-84.

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生态入侵植物的营养器官结构特性研究(摘要)

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[**目的**]探讨生态入侵植物营养器官对环境的适应特性。
[**方法**]采用高清显示植物组织晶体方法和石蜡切片法,对吉林省长春市郊区环境中的菊科豚草属三裂叶豚草(*Ambrosia trifida* L.)的营养器官根、茎和叶横切面的组织结构进行了观察。
[**结果**]生态入侵植物三裂叶豚草营养器官适合生态入侵的结构基础主要是通过加强根系的水分吸收和输导功能、提高茎叶的水分贮藏功能、降低茎叶水势促进植物对水分的吸收以及加强叶片的同化作用来实现在各种复杂环境条件下迅速生长发育,从而实现有效的生态入侵。
[**结论**]为三裂叶豚草生态入侵的生物基础研究提供了参考。

关键词 三裂叶豚草;晶体;生态入侵;结构基础

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