

Investigation on Damage Regularity of *Mikania micrantha*

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Abstract [Objectives] The paper was to understand the occurrence and damage regularity of the invasive plant *Mikania micrantha* in Huadu District of Guangzhou. [Methods] The damage status of *M. micrantha* in different forest lands and its annual growth dynamics were investigated by field investigation. [Results] With the change of canopy density from low to high, the occurrence degree of *M. micrantha* changed from high to low. The occurrence degree of *M. micrantha* in different forest land types was: abandoned orchard > wasteland > roadside greenbelt > waterside > forest edge > normally managed orchard. [Conclusions] *M. micrantha* enters the rapid growth period from March to May in spring, with the growth rate gradually slowing down after June. The result provides a theoretical basis and practical guidance for the prevention and control of *M. micrantha*.

Key words *Mikania micrantha*; Regularity of outbreak; Coverage survey; Monitoring; Prevention

1 Introduction

Mikania micrantha, belonging to Asteraceae, is a perennial non-woody vine that grows extremely fast and is known as "Mile-a-minute-weed" [1–2]. Native to Central America, *M. micrantha* is one of the most harmful tropical and subtropical plants in the world [3] and one of the 14 kinds of quarantine forest plants in China. It has invaded more than 20 countries and regions in Asia and Oceania, and now has become one of the most harmful alien invasive plants in South China [4–7]. Effective prevention and control of *M. micrantha* has become one of the global challenges [8]. *M. micrantha* was introduced into Guangdong Province in the 1980s [9–11], then began to spread to the Pearl River Delta region in the 1990s, and continued to spread to surrounding areas, causing disasters [12]. In 2000, *M. micrantha* was first found in Huadong Town, Huadong District, and then spread to adjacent towns and streets, with the damage increasing year by year. At present, it has been found in 6 towns and 4 streets across the district, among which the town streets with the largest occurrence area and most distribution points are Huadong, Shiling, Huashan, Chini and Tanbu towns, and those with the least occurrence area and few distribution points are Xinya Huacheng, Xinhua and Xiuquan streets and Timian Town. In the past 3 years, the total cumulative area of the prevention and control of *M. micrantha* in Huadu District has reached 10.667 million hm², and more than 3 million yuan has been invested in the prevention and control to curb the spread of *M. micrantha*. To improve the prevention and control effect, this paper investigated the natural occurrence and damage regularity of *M. micrantha* in Huadu District, which play a vital role in scientifically determining the key areas of prevention and control, improving the pertinence of prevention and control, and making the best use of limited funds for prevention and control.

2 Investigation content and methods

2.1 Investigation of damage degree Nine different types of areas were selected: wasteland, waterside (stream side or pond side), roadside greenbelt, normally managed orchard, abandoned orchard, forest edge, underforest [high canopy density (0.8 and above) forest, medium canopy density (0.51–0.79) forest, low canopy density (below 0.5) forest]. Eight plots with an area of 2 500 m² were selected from each type of area without manual intervention (without control and other weeding care measures against *M. micrantha* in recent 3 years). The coverage of *M. micrantha* was investigated during its blooming period (late November), and the occurrence and damage situation of *M. micrantha* in different types of plots was statistically analyzed.

2.2 Investigation of field growth dynamics From January to December 2022, 10 fixed standard plots with an area of 2 000 m² were selected in areas where *M. micrantha* had seriously damaged. Fifty survey plots of 1 m² were uniformly set up using grid counting method, and the coverage change of *M. micrantha* in standard plots was investigated once a month in the middle of each month. The growth dynamics of *M. micrantha* in the field were analyzed statistically.

3 Results and analysis

3.1 Damage degree in different types of plots The survey results (Table 1) showed that there were obvious differences in the occurrence and damage degree of *M. micrantha* among different types of plots. *M. micrantha* generally had mild occurrence in the forest, with almost no occurrence in high canopy density forest (average canopy density 0.88, average coverage of *M. micrantha* 0.01%), very little occurrence in medium canopy density forest (average canopy density 0.70, average coverage of *M. micrantha* 0.74%), and sporadic occurrence in low canopy density forest (average canopy density 0.46, average coverage of *M. micrantha* 7.46%), and it basically would not cause a disaster.

Table 1 Occurrence and damage degree of *Mikania micrantha* in different forest land types

Forest land type	Coverage of <i>M. micrantha</i> //%								Average
	Sample plot 1	Sample plot 2	Sample plot 3	Sample plot 4	Sample plot 5	Sample plot 6	Sample plot 7	Sample plot 8	
High canopy density forest	0	0.05	0	0	0.02	0	0	0	0.01 f
Medium canopy density forest	0	0.1	2	1.8	1.2	0	0	0.8	0.74 ef
Low canopy density forest	10.5	8.2	4.8	9.1	6.4	5.8	11.2	3.7	7.46 d
Forest edge	17.6	15.4	22.8	25.8	16.9	33.2	25	25.2	22.74 c
Waterside	32.6	34.1	35.8	41.6	45.8	39.7	50.6	46.2	40.80 b
Wasteland	88.4	76.9	65.2	55.7	90.4	63.2	57.3	60.4	69.69 a
Normally managed orchard	0.5	1	2.5	0.9	1.5	0	0	3.1	1.19 e
Abandoned orchard	64.3	58.2	92.4	88.8	76.4	71.5	82.6	85.2	77.42 a
Roadside greenbelt	30.5	31.8	45.6	55.2	29.3	65.8	46.8	60.3	45.66 b

Note: Different lowercase letters indicate significant difference at 0.05 level.

M. micrantha mainly occurred in wasteland, abandoned orchard (mainly abandoned litchi orchard), waterside (unsupervised stream side and pond side), unwatched roadside greenbelt and forest edge. Abandoned orchard and wasteland were seriously damaged by *M. micrantha*, with the average coverage of 77.42% and 69.69%, respectively; followed by unwatched roadside greenbelt (45.66%) and waterside (40.80%). In normally managed orchards, *M. micrantha* only occurred sporadically with low average coverage (1.19%) due to frequent weeding management.

3.2 Field growth dynamics The survey results (Table 2) showed that the coverage of *M. micrantha* at the beginning of the year was relatively low, which was because the aboveground part

of *M. micrantha* began to die after flowering and bearing in the winter of the previous year. Therefore, the coverage of the aboveground part was relatively small. *M. micrantha* begin to grow rapidly as the temperature rises in spring, and the period from March to May is the rapid growth period of *M. micrantha*. After June, with the appearance of high temperature weather, sometimes accompanied by high temperature and drought, *M. micrantha*'s growth rate gradually slows down, and reaches the maximum coverage in October. *M. micrantha* begin to bloom in middle and late October, and reaches the peak flowering stage in November. In December, most of the seeds are matured, and some of the aboveground stems and leaves begin to die.

Table 2 Field growth dynamics of *Mikania micrantha*

No. of sample plot	Coverage of <i>M. micrantha</i> //%											
	January	February	March	April	May	June	July	August	September	October	November	December
1	5.5	6.5	9.2	17.2	25.3	35.6	43.5	49.6	54.8	58.2	60.2	35.6
2	10.5	15.5	30.6	50.2	76.5	88.6	90.5	91.2	91.6	92.0	89.6	66.9
3	9.6	12.3	25.8	40.3	60.7	69.4	75.6	76.4	80.6	85.3	83.6	55.1
4	4.3	4.8	8.9	13.6	20.5	29.4	36.8	41.2	50.1	55.2	59.3	35.4
5	15.2	16.7	35.6	56.9	86.3	88.6	92.1	90.5	91.2	87.5	85.5	57.4
6	6.4	8.9	19.9	35.9	41.9	45.6	48.2	48.7	50.1	51.2	52.0	26.4
7	6.8	6.9	10.8	14.8	16.4	17.9	18.6	22.1	22.6	25.6	26.1	16.5
8	20.1	22.6	45.6	78.6	93.1	92.8	94.1	93.2	94.0	93.8	90.6	65.8
9	11.1	12.1	23.8	37.6	42.9	49.3	54.1	60.1	70.1	72.3	73.5	36.2
10	7.8	8.6	15.6	30.6	45.3	59.3	63.7	69.5	75.6	78.9	80.1	42.8
Average	9.73	11.49	22.58	37.57	50.89	57.65	61.72	64.25	68.07	70.0	70.05	43.81

3 Conclusions and discussion

Field investigation showed that *M. micrantha* rarely occurs in the forest, especially in the closed forest. There is no danger of disaster in a manually managed orchard. The main areas affected by *M. micrantha* are abandoned orchard (mainly litchi orchard), wasteland, unmanaged waterside, forest edge and roadside greenbelt. These areas should be regarded as the key areas for monitoring and control of *M. micrantha*, and each town and street, with the forest chief system as the starting point, should organize monitoring and control according to the principle of territorial management. *M. micrantha* enters the rapid growth period from March to

May in spring, with the growth rate gradually slowing down after June. It begins to bloom in October, reaches its peak in November, and reaches seed maturity in December. Therefore, we should seize the opportunity and carry out prevention and control of *M. micrantha* during the rapid growth period in spring, which can reduce the workload of control. Control should be carried out before November at the latest to prevent *M. micrantha* from fruiting that will affect the control effect. Artificial control, chemical control^[13-17] and comprehensive control measures should be adopted to implement the epidemic prevention and control of *M. micrantha*.

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method is also suitable for the shaping of young trees such as apple and cherry, and the management of low-age branches in the process of high grafting and upgrading of traditional big trees.

4 Cautions

(i) This method is suitable for bending branches of the current and 1–2 year old branches, especially for bending base branches of the crown at the shaping stage of young trees. If the middle and upper branches of the crown can be braced, bending branches should not be used as far as possible.

(ii) For shoots of 1–2 years old, the bending operation should be conducted 20 d after flowering and terminated before the first pause of branch growth. Bending branches too early is easy to grow back branches, while bending branches too late can not form flower buds in that year.

(iii) The ground part of bamboo skewer should not be too long, and the over-long part should be cut, retaining only 1–3 cm. Bamboo skewer should not be replaced by iron wire or iron skewer, and the joint of burlap thread or cloth strip connected with bamboo skewer should be as close to the ground as possible to prevent the skewer part from being exposed to the sun, resulting in a

decline in toughness and fragileness.

(iv) The ground peg should be inserted within the row to the greatest extent, so as not to affect the mechanical and manual work as much as possible.

References

- [1] XU JT, LI LF, GAO LJ, *et al.* A training system of pear trees for high density cultivation and simple pruning techniques[J]. *Northern Horticulture*, 2021(19):168–170. (in Chinese).
- [2] XU JT, ZHAO HY, LI YH, *et al.* Effect of trimming pattern on growth and light utilization of ‘Huang-guan’ (*Pyrus bretschneideri* Rehd.) seedlings[J]. *Journal of Northwest A&F University (Natural Science Edition)*, 2015, 4(43):85–90. (in Chinese).
- [3] HAO BF, XU JT, LI LF, *et al.* A shaping method of slender upright trunk shape of pear tree: China, ZL201710034846.0 [P]. 2020-03-17. (in Chinese).
- [4] HAO BF, XU JT, LI LF, *et al.* A method of opening girdle angle during shaping of young pear trees: China, ZL201710034835.2 [P]. 2021-04-27. (in Chinese).
- [5] HAO BF, XU JT, GAO LJ, *et al.* A method of bending branches during shaping of young pear trees: China, 201711189400.1 [P]. 2018-04-13. (in Chinese).
- [6] LI MG, ZHANG WY, LIAO WB, *et al.* The History and status of the study on *Mikania micrantha*[J]. *Ecologic Science*, 2000(3): 41–45. (in Chinese).
- [7] ABRAHAM M, ABRAHAM CT. Mile-a-minute weed effects on crop plants[J]. *Indian Farming*, 2005(2): 9–10.
- [8] ZAN QJ, WANG YJ, WANG BS, *et al.* Distribution and damage of the exotic weed *Mikania micrantha*[J]. *Chinese Journal of Ecology*, 2000(6): 58–61. (in Chinese).
- [9] XU SC, GAO YB, LIN XP, *et al.* Occurrence and control of *Mikania micrantha* in Guangdong Province and advances in research[J]. *Guangdong Forestry Science and Technology*, 2013, 29(4): 83–89. (in Chinese).
- [10] GUO QX, HUANG Z, YU WT, *et al.* The potential distribution of quarantine *Mikania micrantha* in China[J]. *Chinese Journal of Tropical Crops*, 2013, 34(1): 176–180. (in Chinese).
- [11] YU F, WU HR, LU YG, *et al.* Present invasion situation and controlling for alien weeds in Renping Peninsula[J]. *Weed Science*, 2012, 30(2): 11–14. (in Chinese).
- [12] ZHANG WY, WANG BS, LIAO WB, *et al.* Progress in studies on an exotic vicious weed *Mikania micrantha*. [J]. *Chinese Journal of Applied Ecology*, 2002(12): 1684–1688. (in Chinese).
- [13] MINI A, ABRAHAM C. Biology of mile-a-minute weed (*Mikania micrantha* H. B. K.), an alien invasive weeds in Kerala[J]. *Indian Journal of Weed Science*, 2005(37): 153–154
- [14] KONG GH, WU QG, HU QM, *et al.* Further supplementary data on *Mikania micrantha* H. B. K. (Asteraceae)[J]. *Journal of Tropical And Subtropical Botany*, 2000(2): 128–130. (in Chinese).
- [15] WANG BS, LIAO WB, ZAN QJ, *et al.* The Spreads of *Mikania micrantha* in China[J]. *Acta Scientiarum Naturalium Universitatis Sunyatseni*, 2003(4): 47–50. (in Chinese).
- [16] HE LP, LIANG QY, YANG RH, *et al.* An exotic weed: *Mikania micrantha*: Its distribution and harmfulness in shenzhen[J]. *Forestry Science and Technology*, 2000(3): 38–40. (in Chinese).
- [17] FENG HL, CAO HL, LIANG XD, *et al.* The distribution and harmful effect of *Mikania micrantha* in Guangdong[J]. *Journal of Tropical and Subtropical Botany*, 2002(3): 263–270. (in Chinese).
- [18] HUANG HZ, ZHAO JB, HUANG BK, *et al.* Phenoxy-hydroxy-acid herbicides for controlling the weed *Mikania micrantha*[J]. *Journal of South China Agricultural University*, 2004(1): 52–55. (in Chinese).
- [19] WANG YJ, LIAO WB, ZAN QJ, *et al.* Effects of the herbicide sulfo-meturon-methyl killing *Mikania micrantha* and their influence on plant diversity[J]. *Acta Scientiarum Naturalium Universitatis Sunyatseni*, 2003(S1): 180–186. (in Chinese).
- [20] LIU XY, CAO AC, LI Y, *et al.* Effective control of several herbicides on *Mikania micrantha*[J]. *Journal of Biosafety*, 2012, 21(3): 216–220. (in Chinese).
- [21] LIN XP, LIU JF, HUANG Y, *et al.* Safety and control effect of herbicide Mieweijing against *Mikania micrantha*[J]. *Forest Pest and Disease*, 2009, 28(1): 30–31. (in Chinese).
- [22] ZHANG H, SUN DY, XU XD, *et al.* Field efficacy test of Ziweiqing against *Mikania micrantha*[J]. *Liaoning Forestry Science and Technology*, 2012(6): 12–14. (in Chinese).

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References