Study on the Production effect and Prevention Index of the Forthputting of *Sonsau Cocuus Sinensis Chen* on the Pinus Tabulaeformis

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Abstract—The growth of Pinus tabulaeformis is influenced by the *sonsau cocuus sinensis chen*. When the insect density is more than 300-350 head/hundred beam conifer, *sonsau cocuus sinensis chen* occurred significantly influence the Pinus tabulaeformis′s growth. When the insect density reached 250-300 head/100 beam coniferous, son*sau cocuus sinensis chen* significantly influence the accumulation of Pinus tabulaeformis volume. To determine the *sonsau cocuus sinensis chen* 2nd instar nymph theory control index was 220.5 /hundred beam needles has a guiding significance to the production practice.

Keywords-sonsau cocuus sinensis chen; pinus tabulaeformis ; control index.

Sonsau cocuus sinensis Chen also known as the pine needle scale, takes place every year in Henan area of a generation, late June to mid August for diapause period, from August to September and the following March to April for the harmful period, mainly in the 2nd instar nymphs of harm, harmful mainly to oil Pinus tabulaeformis. Harmfull Methods: Parasitism in the pine needles′ inside in the current year , by mouthsucking the juice of the leaves, resulting in coniferous become yellow and fall,thus can't grow new leaves, eventually leading to branches to wilt, seriously affected the growth of pine. In recent years, *sonsau cocuus sinensis chen* pest on Pinus tabulaeformis showed an upward trend year by year. By the continuous observation and investigation on the test land, and study of the change of the amount of the *sonsau cocuus sinensis chen* in different population of density level, and based on the analysis to determine the 2nd instar nymph period of damage control index, so as to provide a scientific basis for prediction and prevention and cure of the *sonsau cocuus sinensis chen*

B. Sampling method

Pine crown is divided into upper, middle and lower 3 layers and the South and North 2 range, a total of 6 parts, selected 2 branches from each part to count their Insect population (each branch is not less than 20 beam), the average of every branch of insect pest density is the density of Pinus tabulaeformis. Per 100 beam leaves of 50 head of grade 1, divided into 9 insect density level.

2) Measurement of diameter growth

From the beginning of 2004, March of each year (two instar),investigate the number of insect population on each Pinus tabulaeformis ,and mark it according to the

I. MATERIALS AND METHODS

A. General situation of the observation land

Observatory land is located in the East Bay of Lushi County of Sanmenxia city in Henan. It is a warm and semi-arid continental monsoon climate, the annual average temperature is 12.6 centidegree, the coldest Month is January, the hottest Month is July and frost free period is 184 D; an average annual sunshine hours are 2118 h; the average annual rainfall is 647.8 mm, mainly occurred in July~September[1].And this forest tree's characteristics are mainly for Pinus tabulaeformis, followed by Carya cathayensis, Robinia pseudoacacia etc、under the bush shrubs Ziziphus jujubavar.spinosa、Vitex negundo 、 Pyrus calleryana ect.Vitex negundo, ground cover plants are Themeda triandra and the Pennisetum flaccidum etc.

This experiment include 4 standard representative sites, conditions as the following Tab.1,each standard area of 50mx50m,at the same time requirements for the number of Pinus tabulaeformis of each standard site is not in less than 90 plants.

TABLE.I. THE STANDARD SITE CONDITION

Standard No.	The Height(m)	The Aspect	The slope	The percentage of infection of the insect pest of plant (%)	Crown Density	The average age of the plant (a)
1	820	The Piedmont Plain	0	79	0.8	40
2	1040	The Valley Flat	0	90	0.7	50
3	1150	Slope	9	86	0.8	40
4	1280	The sunny	11.5	88	0.8	40

1) Definition of the insect mouth density level:

insect density level. At the same time measure the diameter of each Pinus tabulaeformis and mark it. Record every survey data. At the same time of the following year, by five point sampling method, which is near the four corners of the stardard site, namely around the center point randomly selected not less than 2 plants of Pinus tabulaeformis according to the insect population density level, a total of 120 samples .Measuring and recording the strain, calculated the amount of annual growth of diameter at breast height. To the year 2008, records 4 times, made 4 sets of data.

3) Calculation of volume growth

According to volume formula in the ",the main species of tree volume and shape high table, Henan Province ",which is issued in july,1998, calculate 4 annual growth volume under the influence of the insect population density.

The mountain tree Unitary standing tree volume calculation formula is as follows:

$$V=a(b+cD)e.[f+g(b+cD)-h(b+cD)2]i.$$

D diameter

For Pinus tabulaeformis, type in:

a=0.000093059   b=-0.3153   c=0.98317   e=1.992682

f=0.45060   g=0.621517   h=0.0051748   i=0.6711661

4) Determination of nymphs harm period control index

According to the control cost and control effect, according to the economic level and economic threshold allows the hazards, analysis to determine the two instar nymph period of damage control index.

II. RESULTS AND ANALYSIS

A. Influence the occurrence of Chinese pine shoot scale increase of pine DBH

Significance test is carried out to survey 4 years 2004-2008 years of Chinese pine DBH growth amount of results, developed the effects of different population density of pine shoot scale to pine DBH growth volume table (see Table 1),it is seen from table 2 can, with the increase in population density, diameter at breast height growth of Pinus tabulaeformis were decreased trend, shows that the Chinese pine shoot scale damage effects of DBH growth of Pinus tabulaeformis. When the population density of essthan 300-350 per hundred beam conifer, Pinus tabulaeformis DBH growth by the pine shoot pest is not significant; when the insect density reached 300-350 head/100 beam conifer, Pinus tabulaeformis DBH growth between the quantity and the control showed significant difference.

TABLE.II. EFFECT OF DIFFERENT DENSITY OF INSECT PEST OF CHINESE PINE SHOOT OF CHINESE PINE DBH GROWTH AMOUNT

Population density(head/100 beam needle)	DBH growth quantity(cm)					
	2004-2005	2005-2006	2006-2007	2007-2008	The average annual	Annual and
350above	0.078	0.049	0.143	0.079	0.087	0.349 b
300-350	0.123	0.280	0.431	0.327	0.290	1.161 ab
250-300	0.215	0.455	0.599	0.575	0.461	1.844 a
200-250	0.337	0.602	0.639	0.626	0.551	2.204 a
150-200	0.445	0.630	0.676	0.662	0.603	2.413 a
100-150	0.451	0.633	0.715	0.630	0.607	2.429 a
50-100	0.322	0.665	0.743	0.638	0.592	2.368 a
0-50	0.321	0.687	0.743	0.690	0.610	2.441 a
CK	0.322	0.674	0.743	0.739	0.620	2.478 a
Total	2.614	4.675	5.432	4.966		17.687

B. Influence the occurrence of Chinese pine shoot scale increase of Pinus tabulaeformisvolume

The occurrence of the Chinese pine shoot scale effect on the growth of Pinus tabulaeformis volume weight is shown in Table 3, significant test shows that, when the population density reached 250-300 head/100 beam coniferous, volume growth was significantly different between the quantity and the control.

TABLE.III. THE EFFECT OF OCCURRENCE OF PINE SHOOT SCALE INCREASE OF PINUS TABULAEFORMISVOLUME

Population density(head/100 beam needle)	Volume increment (cm)					
	2004--2005	2005--2006	2006-2007	2007-2008	The average annual	Annual and
350above	0.0008	0.0005	0.0015	0.0009	0.00009	0.0038b
300-350	0.0013	0.0031	0.0050	0.0041	0.00034	0.0134 ab
250-300	0.0023	0.0052	0.0075	0.0079	0.00057	0.0230ab
200-250	0.0038	0.0074	0.0087	0.0093	0.00073	0.0292a
150-200	0.0047	0.0072	0.0087	0.0094	0.00075	0.0300a
100-150	0.0048	0.0074	0.0094	0.0092	0.00077	0.0308a
50-100	0.0036	0.0081	0.0100	0.0098	0.00078	0.0314a
0-50	0.0035	0.0081	0.0098	0.0102	0.00079	0.0315a
CK	0.0034	0.0078	0.0096	0.0107	0.00079	0.0316a
Total	0.0282	0.0548	0.0702	0.0714		0.2247

C. Determination of Chinese pine shoot pest control index

The occurrence of the Chinese pine shoot scale has affected the growth and volume of Pinus tabulaeformis growth. As for Chinese pine shoot scale effective prevention and treatment, and obtained better economic benefit, formulate scientific and reasonable control index is the key problem to be solved.

1) Establishes the regression equation:

Table 3 the insect mouth density interval intermediary values, then the intermediate value and, annual volume average growth of the regression analysis, a relationship between the two (parabola, two regression) are as follows:

$$y=0.0075135+0.000016354x-0.000000088679x^2$$

$$r=-0.8561$$

2) Determine the control index:

According to the regression equation, the insect mouth density(Z)of Pinus tabulaeformis growth and volume(V)relationship model:

$$Vz=0.0075135+0.000016354Z-0.000000088679Z^2:$$

When Z=0, V0=0.0075135

Make Vz'for the loss amount per hectare pine volume, is a function of population density of Z, then:

$$Vz'=V0-Vz=-0.000016354Z+0.000000088679Z^2$$

According to Ci=Vz'*Si*Ni*Mi, where Ci is the cost of control($/hm2),Si value($/m3)of Pinus tabulaeformis,

Ni as the control effect, Mi number per hectare pine tree, there are:

$$Ci=Vz'*Si*Ni*Mi$$

$$=(V0-Vz)*Si*Ni*Mi$$

$$=(-0.000016354Z+0.000000088679Z2)*Si*Ni*Mi$$

After that a market survey in recent years, the average value of Chinese pine(Si)of about 500 yuan/m3,stem number per hectare(Mi)about 1000 strains, the control effect(Ni)was 80%,the cost of control(Ci)is 300 yuan/hm2,there are:

$$300=(-0.000016354Z+0.000000088679Z2)*500*0.8*1000$$

That is: $0.037689Z2-6.95045Z-300=0$

Solutions of Chinese pine shoot pest control index of Pinus tabulaeformis:

$$Z=220.5(head/100 beam coniferous)$$

According to the occurrence and development regularity of pine shoot scale, life habit and the insect mouth density influence the correlation between diameter at breast Height and of pinus tabulaeformis growth, to determine the two instar theory control index was 220.5 per hundred beam coniferous, has guiding significance for production practice

III. CONCLUSION AND DISCUSSION

Increase the volume of Pinus tabulaeformis growth and DBH are subject to damage of Chinese pine shoot scale. When the population density of less than 300-350 per hundered beam coniferous, no loss of DBH growth, when the insect density more than 300-350 per hundred beam coniferous ,Chinese pine shoot scale significantly affect pine growth; effect on volume growth, when zhe population density of less than 250-300 per hundred beam coniferous, volume accumulation is not affected, when the insect density reached 250-300 head/100 beam needles at the pine shoot scale significantly influence the accumulation of Pinus tabulaeformis volume.

By calculation, determine the pine shoot scale main harmful pest period(2 instar) theory control index was 220.5 per hundred beam coniferous. But the control index is not fixed, will because of the difference of insect and harm of season, the level of management and control measures, control effect, control cost, natural enemies and climate factors and soil condition and different. Limited by the experimental condition, may also exist certain errors in the formulation of control index. Therefore, all localities should be adjusted according to the actual situation in the implementation.

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