Occurrence and control of rapeseed stem veevil (*Ceuthorhynchus asper* Roel.) in northwest China

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Abstract

Rapeseed stem veevil (*Ceuthorrhynchus asper* Roel) is the main rapeseed pest in northwest China, and occurs one generation per year with adult overwintering. The life cycle differ in different area and ecological condition or local climate. For example, different planting region of rapeseed and elevation effect its occurence. In the sloping fields facing sun of the same region, rapeseed stem veevil occurred earlier than in plain and shady fields. In winter rapeseed region, its adults have oversummering habit. In spring rapeseed region, most rapeseed stem veevil overwinter directly under cool climate after pupae becoming into adults. Therefore, to understand the development of rapeseed stem veevil is very important for controlling the insect by using chemical and agricultural measures in the critical period.

Key words: rapeseed stem veevil, occurrence, control

Rapeseed stem veevil is the main rapeseed insect in northwest China such as Guanzhong, its incidence is about 20%-30% in normal years, lose yield around 20%. In serious years, the incidence is over 40%, and lost yield about 30%-40%. Because the the insect reduced production of rapeseed greatly. To study its development and life cycle in the field is useful for making control measures.

1. Materials and methods

1.1 Rearing and observation in the field In Dali County of Shanxi Province, adults of rapeseed stem veevil were collected in the mid-May and put in pots where the rapeseed were planted, the plants were covered with nylon net in field. Three couples of adults were put in each pot, and rapeseed plants were removed after adults went into soil for oversummer. At the beginning of September, *Brassica napus* L was sowed in those pots. After seedling, activities of rapeseed stem veevil out of soil and its feeding habits were observed systematically till overwinter. February of the following year, we continued to observe adults' activities stage out of soil, feeding, mating, spawning, pupating, oversummer and other habits, and computed duration of each stage.

1.2 Systematic observation in field Damaging of rapeseed stem veevil was investigated in some representative fields selected, such as Dali, Xi'an, Fufeng, Liuba, Ningshaan and Taibai etc, the effect of occurrence regularity and damaging characteristics of rapeseed stem veevil in the different planting regions, altitude, hypsography and host etc. were compared.

1.3 Field investigation in other provinces Occurrence and damaging characteristics of rapeseed stem veevil in Linxia of Gansu province, Ledou of Qinghai province and Zhaosu of Xinjiang were investigated through field investigation and checking informations.

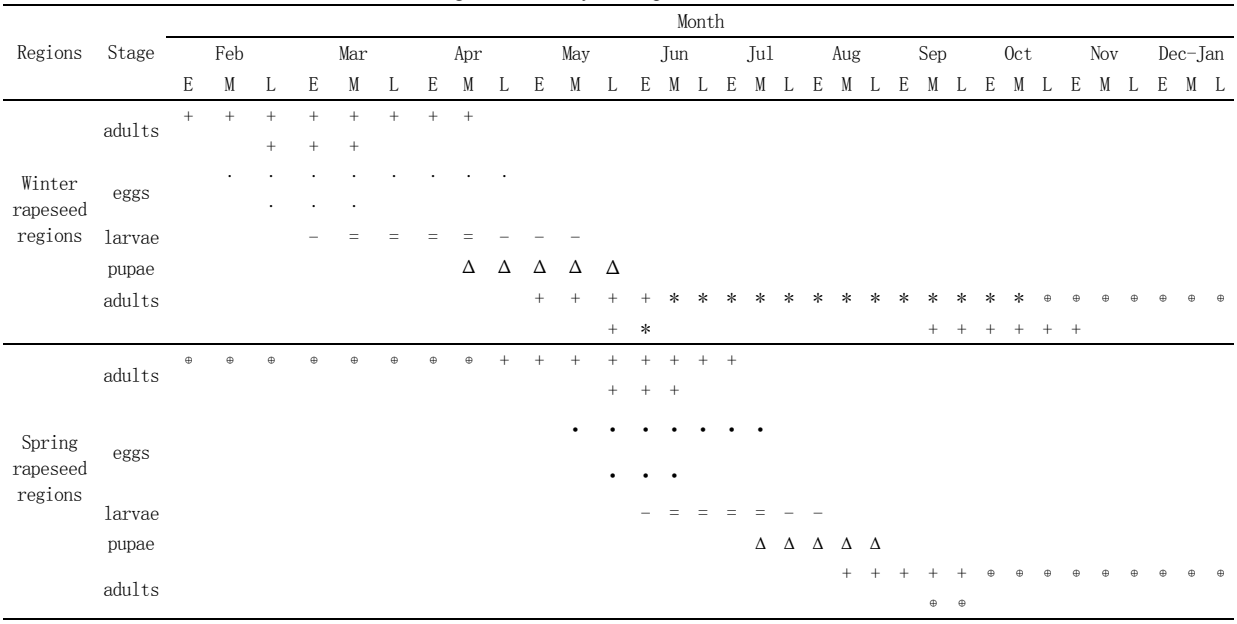
1.4 According to the result of investigation to draw map of the life cycle of rapeseed stem veevil and make prevention measures.

2. Results and analysis

2.1 Occurrence The study showed that rapeseed stem veevil occur one generation per year in the north-west in China (Fig.1), their adults overwinter in around 5cm.soil in host field. In winter rapeseed regions of the north-west in China, from the early-Feb. to the mid-Mar. (daily average temperature about 5°C), adults of rapeseed stem veevil come out of soil in succession, and soon seek consorts to mate, after about 3 days, female adults begin to lay eggs. The period of laying peak is always at the late-Feb. to the mid- Mar.. The eggs stage is around 10days, and larval stage is 25 to 35days, total three stadiums. From mid-Mar. to the mid-Apr. is the active period of larvae that damage rapeseed. From the mid-Apr. to the mid-May, mature larvae unthread stems and go into soil about 3 to 6cm from the soil surface to build house for pupation, pupa period is 20days or so. From the mid-May to the early-Jun, pupae hatch to adults and damage rapeseed or other host plants. And when temperature rises 24 to 28°C, adults go into soil to oversummer in succession at the early-Jun. In autumn, part of adults come out of soil to damage rapeseed from mid-Sep. to the late-Oct., then go into soil to overwinter. And that another part of adults overwinter directly till next year. In the spring rapeseed region of northwest, adults of rapeseed stem veevil come out of soil in succession from the late-Apr. to the mid-May, and mate and lay eggs from the mid to late-May. Always, the period of laying peak is from the late-May to mid-June. The active period that larvae damaged rapeseed is from the mid-Jun. to the mid-Jul.. And mature larvae do not damage stems and go into soil to pupate from the mid-Jul to mid-Aug. The pupae hatched to adults

from the mid-Aug. to the mid-Sep., and damaging rapeseed or other host plants through obtaining food from them, and go into soil for overwinter from the mid-Sep. to the early-Oct. till Apr.of next year.

Fig 1 The life cycle of rapeseed stem veavil



Note: + adults ; • eggs; - larvae ; Δ pupae; ✱adults of oversummer; ⊕overwintering adults; double deck fig means the peak stage of occurrence or generation overlapped; E: early-month ; M: mid-month; L: late-month.

2.2 Living habits Larvae of rapeseed stem veevil catch food from hosts' pith, and adults mainly from hosts' leaves and young stems and inflorescences, and strong hunger resistance of adults may keep alive without food about 20 days. And adults have habit of feign death, if meeting wind or touched, they furl heads and beaks and feet, and shrink into themselves and roll down from plants immobility, no phototaxy. Their activity period is from 11a.m. to 4 p.m. in windless and sunny day with 15-20°C. When temperature is over 24°C, adults go into the soil or stay in the shade with immobility or oversummer. Besides, adults of rapeseed stem veevil may mate many times, and the fastigium is at 9-11 a.m. and at 4-6 p.m. every day. Female adults bore hole by beak in tender stems, then lay eggs in the hole. The female may lay 3-7 eggs, even more than 20 eggs. Generally, the single plant may attach 2-6 eggs. Volitation ability of adults is weak, they just fly several meters once and often intermittence fly with wind. Besides rapeseed, the hosts of rapeseed stem veevil have Chinese cabbage, greengrocery, mustard, cabbage, radish as well as weeds of cruciferae, such as *Descurainia sophia L.,Erysimum cheiranthoides L.,Capsella bursa-pastoris L.etc.*

2.3 Damaging characters Rapeseed stem veevil larvae mostly bore stems and cause them empty. The study showed that in the course of adults laying and hatching and their larvae boring stems, rapeseed stem veevil can excrete injurant to stimulate plants to make the damaged tissue loose and stems swollen and distorted until cracking, and cause rapeseed lodging easily in wind and raining. Damaged plants grow slowly and become stunted. The branches of severly damaged plants are short with little pods, and even stop growth, in some case many branches become cluster under damage position. From our survey, damage periods of overwinter adults are not consistent with different climate and geographical elevation in different plant regions, even the difference is significant. Commonly, the activity period and egg-laying postpone correspondently with rising geographical elevation. In winter rapeseed regions under 600m elevation, overwintered adults come out of soil in succession from the early-Feb. to the early-Mar., most of them mate and lay from the late-Feb. to the early-Mar. In those regions with over 600m elevation, overwinter adults come out of soil from the late-Feb. to the mid-Mar., and most of them mate and lay from the early to the mid-Mar. In very cold spring rapeseed regions with over 1500m elevation, adults come out of soil from the late-Apr. to the mid-May in succession, and most of them mate and lay from the late-May to the mid-Jun.. Besides, in the sloping fields facing sun of the same region, rapeseed stem veevil occurrs earlier than in plain and shady fields.

2.4 Control measures According to damaging characters of rapeseed stem veevil, for shorting damaging period of adults laying on tender stems, we must pay attention to manage during rapeseed buds period to hasten rapeseed growth rapidly and stably. On cropping systems, rational rotation must be stressed,it is best to rotate rapeseed and gramineous crops. At the same time, to weed out wildness hosts in field completely through cultivating weed control.

To moniter and forest the occurrence of rapeseed stem veevil is very important for chemical control in time. Controlling adults before laying is the key stage, commonly the period is from late-Feb. to the mid-Mar. in Winter rapeseed regions, and from mid-May to the early-Jun. in Spring rapeseed region (the beginning of stem elongation period, stem length about 2-5cm). The best period for control may be adjusted with different landform and climate. Around one week after the first control, the second control may be needed according to occurrence situation of inse. Chemical control may be carried out during adults damaging period, usually Sep. and Oct. in serious occurrence regions. The common insecticides are decamethrin, cyhalothrin, diamethoate etc.

3. Disscussion

Rapeseed stem veevil (*Ceuthorrhynchus asper* Roel.) damage rapeseed with larvae boring stems. Because of its concealing chracter and inconsistent occurrence in every region, the study on rapeseed stem veevil has been very lack since Li Yuanlin discovered it in 1955 and reported its habits and morphological characters. Wang Fengkui etc. thought that overwinter adults of rapeseed stem veevil, in the central Shaanxi plain, came out of soil from the late-Feb. to the late-Mar., and started to lay and damage rapeseed at the early-Mar., but in Weibei arid platform at the late-Mar.. Larvae have three stadiums, and adults have oversummer habit[1,3].In this study, occurrence regularity of rapeseed stem veevil in the different ecological regions of the north-west in China was surveyed and studied for many years, the results indicated that the time of adults activity of stem veevils out of soil appear earlier in the central Shanxi plain. In most of regions and years, the adults usually come out of soil at the mid-Feb. in succession, and start to lay from the mid to the late-Feb., and the time aheaded a little in some regions and years,. For example, on Feb.7 of 2004, adults activities were discovered in Qishaan of Shanxi Province, and started to damage rapeseed from the late-Feb. to the early-Mar. in dry land.The time aheaded 10d –15d than that of Wang Fengkui. Besides, in spring rapeseed regions with high cold climate, such as Taibai of Shanxi province, Gansu Province, Qinhai Province and Xinjiang, the activity time and occurrence of rapeseed stem veevil are different completely, and overwinter adults activity out of soil is commonly from the late-Apr. to the mid-May, and start to lay and damage rapeseed from the mid to the late-May. After activity for some time, eclosion adults in the same year go into soil for overwinter directly without oversummer habit. Combining activity chracter of rapeseed stem veevil in the same region and under different geography and climate condition, we think weather factors, especially temperature and humidity, are the main reasons to affect occurrence time and the adult population.

The damage characteristics of egg-hatching of rapeseed stem veevil were observed further, the results showed that adults laid on rapeseed leaf stalk before rapeseed stem elongation, and only those eggs that were laid in leaves axil could hatch and then went into stems, for leafstalks were stimulated and split, the others could not go into stems to damage. However, after the initial flowering, rapeseed inflorescence elongate rapidly with the temperature ascending, and stem growth go into the enrich period, stem lignification quicken, phloem become more compact, so it is difficult to adults of rapeseed stem veevil to bore hole for laying. Therefore, though there are still rather much adults of rapeseed stem veevil in the field, their damaging degree to rapeseed is lighten, and focus mainly on these plants which stems growth is slow in buds period. At the same time, parts of adults move to *Capsella bursa-pastoris* L., *Descurainia Sophia* L. etc. and lay on them. So from phenological symbol, the laying damaging phase of rapeseed stem veevil is consistent with the reviving and stem elongation of rapeseed generally.

References

1.Wang, F.K., Wang, X.R.,Shang, Z.F., 1992. A study of biology of Rapeseed stem weevils and their ecological environment on Weibei Rainfed Highland[J]. Agricultural Research in the Arid Areas.10(4):86-89.

2.Li,Y.L., Hu,B.X., 1957: Two new insect pests of rapeseed from Guanzhong region of Shaanxi province[J]. Entomological Knowledge.18(3)：120-123.

3.Wang, F.K., Wang, X.R.,Shang,Z. F., 1990. Estimation on larval instar of *Ceuthorrhynchus asper roelofs* [J]. Acta Universitatis Agriculturalis Boreali-occidentalis.18(3)：107-108.