https://doi.org/10.46344/JBINO.2022.v11i05.12

NATURAL DISTRIBUTION CHARACTERISTICS OF *Codonopsis javanica* (Blume) Hook.F & Thoms IN SON LA

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ABSTRACT

This study was conducted with the aim of evaluating the distribution status of *Codonopsis javanica* (Blume) Hook.F & Thoms species in Son La area. The results show that *Codonopsis javanica* (Blume) Hook.F & Thoms is still distributed mainly in Thuan Chau district, Van Ho district and Song Ma district. The average frequency of occurrence is 3.2 dust/km, the highest in Thuan Chau area is 6.4 dust/km, the lowest in Moc Chau point is 0.2 dust/km. The percentage of mature dust is 63.3%. Flowering and fruiting dust rate 54.4%. The most suitable habitat is natural forest with a canopy cover from 0.3 to 0.5, accounting for 48.8%. The climbing medium is diverse from trees and shrubs, can crawl on the ground, cling to rock crevices, rarely cling to large trees. Elevation occurs from 650 to 1150m above sea level, mainly at the high belt ≤ 1000m, accounting for 60.1%. Distributed in places with good soil, humus, likes moisture but not stagnant water, not waterlogged, near the edge of the forest, in forests with low canopy cover 0.3 - 0.5 and upland areas. The results from this study show that the species *Codonopsis javanica* (Blume) Hook.F & Thoms in Son La is being heavily exploited, the remaining trees are mainly regenerated trees, and the mature bushes are also small bushes. Therefore, planting activities should be carried out to conserve and develop the species with suitable planting areas.

Keywords: *Codonopsis Javanica* (Blume) Hook.F & Thoms, *distribution, high belt, habitat, route, Son La province*.

I. ASK THE PROBLEM

Codonopsis javanica (Blume) Hook.F & Thoms is a vines, tuberous roots with high medicinal value, used as a tonic, to treat weakness, anemia, jaundice, indigestion, etc. (Nguyen Tien) Bin, (2007) [1]). *C. javanica* is a drug that is relatively easy to use because it can be boiled in water, soaked in alcohol or used with other drugs, its aroma and sweet taste is preferred by many people (Do Tat Loi (2006) [4]]; Nguyen Tap (2007) [5]). In the world, *C. javanica* is mainly used in Asian countries, most notably in China, Japan, Korea, Thailand, and Vietnam. Medicinal effects are mentioned as a valuable medicine to treat anemia, weak spleen, stomach pain, kidney inflammation, etc. According to J.Y. He, N. Ma, S. Zhu, K. Komatsu, Z.Y. Li W.M. Fu (2015) [6], the only medicinal part of Party ginseng is the root, with the main components being saponins, polysaccharides, phenylpropanoids, alkaloids, triterpenoids and essential amino acids. The active ingredients in *C. javanica* help the body's metabolic activity better, strengthen the immune system. Because of the nutritional value that *C. javanica* brings compared to the cost of the product, it is also known as "poor man's ginseng".

In Vietnam, *C. javanica* is distributed in many places, but mainly in the northern mountainous provinces such as: Lai Chau, Dien Bien, Lao Cai, Son La, etc. and some southern provinces such as Quang Nam, Kon Tum, Lam Dong, etc. In the world, it has been recorded in India, China, Myanmar, Laos, Thailand, Indonesia (Nguyen Tien Ban (2007) [1]). *C. javanica* is naturally distributed in areas of poor secondary forest, with canopy cover from 0.3 to less than 0.5. In Son La, *C. javanica* is naturally distributed in secondary forests and shifting cultivation. However, most people only harvest from the wild, the main product is tubers, so after harvesting, it will destroy the mother plant layer. If there are no appropriate conservation measures, *C. javanica* is very likely, will face a serious threat. *C. javanica* is recorded in the Vietnam Red Book (2007) under the VU level (Nguyen Tien Ban, (2007) [1]), in group II in the list of endangered and rare forest plants and animals of the Decree No. 06/2019 of the Government of Vietnam [2].

Research on distribution characteristics of *C. javanica* has important implications in proposing solutions on planting areas to conserve and develop species. From that fact, the article presents part of the research results of the topic B2019-TTB-03, focusing on the distribution characteristics of *Codonopsis javanica* (Blume) Hook.F & Thoms in Son La.

II. RESEARCH MATERIALS AND METHODS

2.1. Research Materials

Codonopsis javanica (Blume) Hook.F & Thoms natural distribution in Son La

2.2. Research Methods

- Preliminary investigation based on consultation with forest rangers at Son La Forest Protection Department selected 5 study districts (research sites): Song Ma district, Sop Cop district, Thuan Chau district, Moc Chau and Van Ho districts are confirmed sites with a natural distribution of *C. javanica*.

- Survey by line: In 5 districts, continue to survey the opinions of local officials (rangers, village heads) to open survey lines. Each site establishes 5 lines,

total 25 survey lines. The routes are over 1m in length, extending from the center to the two sides, each side is 5m as a basis for assessing the forest status, distribution and regeneration of Dang ginseng. The route is opened through the following types of habitats: natural forest of mountainous terrain, natural forest of rocky mountains, shifting cultivation, and grass state. On the routes, information about *C. javanica* species was collected, including: Number of individuals (dust), regenerated dust (average length of dust <1m), mature dust (average length of dust ≥1m), material Queen; ecological factors (swidden cultivation/secondary forest, fresh carpet of shrubs, canopy, climbing medium, altitude...), exploitation status (if any).

- The survey data is processed by mathematical statistical method in forestry on Microsoft Excel software [3].

III. RESULTS AND DISCUSSION

3.1. Distribution characteristics of *C. javanica* along survey routes in Son La

3.1.1. Frequency distribution by survey route

The results of the investigation of 25 routes with a total length of 136.01 km, found 441 *C. javanica* bushes, 279 mature bushes with 240 flowering and fruiting bushes. The average frequency of occurrence of *C. javanica* on the routes is 3.3 dust/km. The percentage of mature dust is low, averaging 279 dust/441 dust, accounting for 63.3%. The rate of flowering and fruiting dust is 240/441, only 54.4%, the rate of flowering and mature dust is 240/279, accounting for 86%.

C. javanica is distributed unevenly across survey lines and survey sites. Most naturally distributed in Thuan Chau, Van Ho and Song Ma districts. *C. javanica* is almost absent in the survey sites such as: Moc Chau all 5 survey lines only found 6 *C. javanica* dust, some of which did not appear dust (at Moc Chau 4 route, Muong Sang commune point). Sop Cop point is similar to the above situation, a total of 5 survey lines encountered 7 dust, of which at Sop Cop 3 line, Pung Banh commune point and at Sop Cop 5 route, Nam Lanh commune site did not encounter any dust during the process. investigation process. However, still encountering very few individuals of *C. javanica* also shows that at the study site, there was a distribution of *C. javanica*, but the process of exploitation, shifting cultivation, and use of forest resources has reduced the quantity. individuals decline and are almost no longer in the wild.

Table 01: Results of distribution of *C. javanica* species according to survey routes in Son La

Line	Location	North latitude		East longitude		Line length (km)	Dust number C. javanica (Dust)	Frequency (dust/km)	Flowering and fruiting dust (dust)	Mature dust (dust)
		First point	Final point	First point	Final point					
Moc Chau 1	Dong Sang	20º50’40”	20º47’21”	104º39’8”	104º39’46”	7.22	3	0.4	1	1
Moc Chau 2	Chieng Son	20°47'29”	20°45'11”	104°35'5”	104°36'59”	6.83	1	0.1	0	0
Moc Chau 3	Chieng Son	20°43'57”	20°44'26”	104°36'53”	104°35'11”	4.16	1	0.2	0	0
Moc Chau 4	Muong Sang	20°49'6”	20°48'48”	104°35'33”	104°35'12”	4.82	0	0.0	0	0
Moc Chau 5	Muong Sang	20°49'55”	20°50'8”	104°34'46”	104°34'1”	4.1	1	0.2	0	0
Thuan Chau 1	Pha Din Top	21º34’1”	21º36’18”	103º31’47”	103º32’27”	6.11	42	6.9	20	25
Thuan Chau 2	Copia	21º18’54”	21º20’8”	103º35’15”	103º33’41”	6.53	18	2.8	12	18
Thuan Chau 3	Copia	21°21'3”	21°21'14”	103°35'44”	103°34'55”	5.48	34	6.2	21	21
Thuan Chau 4	Copia	21°19'26”	21°20'29”	103°35'29”	103°36'19”	5.5	29	5.3	15	18
Thuan Chau 5	Pha Din	21°34'3”	21°33'36”	103°32'17”	103°33'54”	4.18	46	11.0	23	27
Van Ho 1	Long Luong	20º45’5”	20º45’45”	104º52’22”	104º49’37”	6.68	53	7.9	33	35
Van Ho 2	Van Ho	20º47’28”	20º47’40”	104º45’29”	104º43’40”	5.34	21	3.9	12	16
Van Ho 3	Chieng Xuan	20°42'47”	20°43'19”	104°45'15”	104°40'47”	8.33	30	3.6	13	17
Van Ho 4	Chieng Xuan	20°43'1”	20°43'18”	104°40'29”	104°38'47”	5.59	21	3.8	18	18
Van Ho 5	Van Ho	20°43'58”	20°44'25”	104°52'18”	104°50'20”	4.64	39	8.4	25	25
Sop Cop 1	Nam Lanh	20º51’40”	20º47’55”	103º30’46”	103º32’24”	7.64	1	0.1	0	0

Sop Cop 2	Nam Lanh	21°0'42"	20°59'28"	103°55'56"	103°54'32"	5.33	2	0.4	0	0
Sop Cop 3	Pung Banh	21°0'43"	21° 2'53"	103°28'18"	103°27'26"	4.45	0	0.0	0	0
Sop Cop 4	Dom Cang	20°59'2"	21° 0'19"	103°34'13"	103°33'41"	3.01	4	1.3	0	0
Sop Cop 5	Nam Lanh	20°54'54"	20°56'11"	103°34'20"	103°33'6"	4.71	0	0.0	0	0
Song Ma 1	Chieng Cang	21º0'42"	20º59'28"	103º55'56"	103º24'32"	5.94	21	3.5	12	19
Song Ma 2	Huoi Mot	21º0'2"	20º58'43"	103º38'48"	103º47'36"	5.78	11	1.9	5	6
Song Ma 3	Huoi Mot	21°1'59"	21° 2'36"	103°37'50"	103°35'42"	4.3	19	4.4	10	11
Song Ma 4	Huoi Mot	21°0'38"	21° 1'37"	103°37'53"	103°37'2"	2.51	15	6.0	5	7
Song Ma 5	Huoi Mot	21°0'10"	20°58'11"	103°38'49"	103°41'42"	6.83	29	4.2	15	15
Total						**136.01**	**441**	**3.2**	**240**	

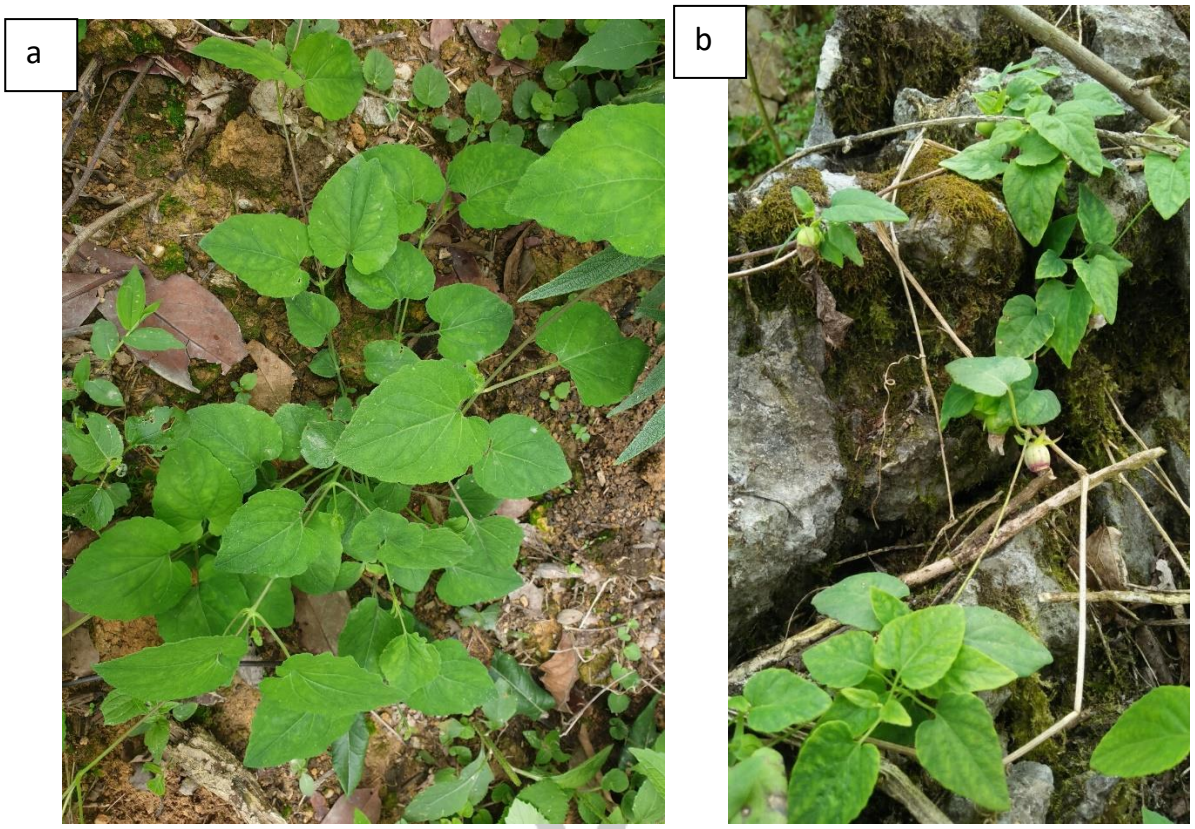

Figure 01: *C. javanica* dust caught at the survey site
(a) Pha Din Top Point (Thuan Chau Line 1); (b) Song Ma point (Song Ma line 3)

In Van Ho district (Van Ho, Long Luong and Chieng Xuan communes). The tree appears in the fields and along the forest. However, in addition to shifting cultivation, bare land adjacent to the forest edge, through the investigation, it was found that due to frequent and frequent spraying of herbicides by the community's swidden activities, there were very few *C. javanica*. On the standard plots, it is shown that in the forest with canopy cover from 0.3 to 0.5, *C. javanica* is found more often than outside the forest edge and upland fields bordering the forest. The investigation results of 5 routes with a total of 30.58 km found a total of 164 dust. Ranging from 21 to 53 dust/line. On average, there are 5.5 dust/km investigated. The total number of adult dust encountered was 111 dust, accounting for 67.7% of the total number of dust encountered. The total number of flowering bushes was 101, accounting for 61.6% of the dust encountered. Thus, at Van Ho survey site, more than 90% of the mature bushes produced flowers and fruits.

In Song Ma district (Chieng Cang and Huoi Mot communes). Chieng Cang commune conducted the survey in Long Pha village. The tree mainly appears in the upland fields of the people and along the forest edges. The deeper into the forest, the less trees appear. However, this place is quite far, 40 km from the town to the commune, 10 km from the commune to the village and must walk if it rains. Huoi Mot Commune: This place is 16 km from town, then walk 4 km to get to *C. javanica*. Trees appear more in upland fields and forest edges, the deeper they go, the less they go. The survey results of 5 routes with a total of 25.36 km found a total of 95 dust, less than in Thuan Chau

and Van Ho areas. Ranging from 21 to 53 dust/line. On average, there are 4.0 dust/km investigated. The total number of adult dust encountered was 58 dust, accounting for 61.1% of the total number of dust encountered. The total number of flowering bushes was 47, accounting for 49.5% of the dust encountered. Thus, the survey site for Song Ma is mainly reborn Dang ginseng, and the mature dust is also mostly small in size.

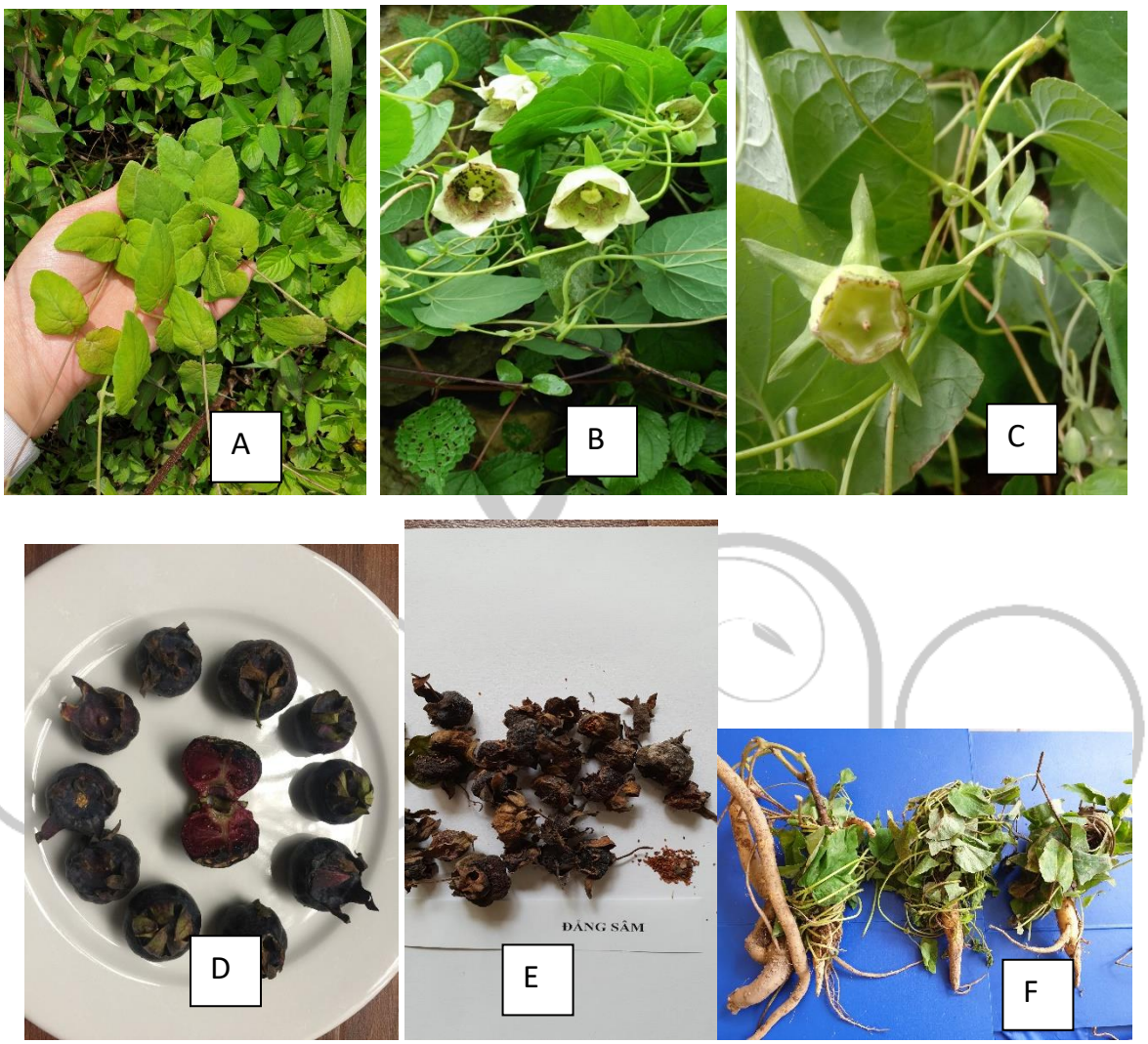

Figure 02: Morphology of young leaves (A), stems and flowers (B), young fruit (C), ripe fruit (D), dried fruit and seeds (E), tuberous roots (F) *C. javanica* encountered during the investigation

The prevalence of adult, large, flowering and fruiting bushes is mainly in secondary forest areas with canopy cover 0.3 - 0.5 and near the edge of the forest. Meanwhile, in swidden areas and fallow grasslands, mainly regenerating C. *javanica* bushes or newly mature bushes, very few flowering and fruiting bushes are encountered.

3.1.2. Characteristics of C. javanica climbing media

The main climbing substrate is any substrate that appears next to it, such as: Rock holes with humus, regenerated trees, shrubs, plants, or crawling under the ground, rarely climbing on large forest trees. . The main cause may be that C. javanica often creeps low, thin body, average adult length is 2.5 - 3.5m.

3.2. Frequency distribution of *C. javanica* according to habitat types and highlands in Son La

3.2.1. Distribution of C. javanica by habitat type

From the survey results, there are 5 types of habitats encountered mainly during the survey: Natural forest on mountains with canopy cover (0.3 - 0.5), natural forest on mountains with canopy cover over 0.5, forest rocky mountains, fields, grasslands. The results obtained are as follows:

Table 02: Distribution of *C. javanica* by habitat types

Numerical order	Habitat type	Number of dust encountered (dust)	Rate (%)	Number of mature dust (dust)	Mature dust percentage (%)
1	Mountainous natural forest with canopy cover 0.3 - 0.5	215	48.8	190	43.1
2	Mountainous natural forest with canopy cover > 0.5	25	5.7	3	0.7
3	Rocky forest	10	2.3	5	1.1
4	Upland farming	112	25.4	51	11.6
5	Grassland	79	17.9	30	6.8
Total		**441**	**100.0**	**279**	**63.3**

C. javanica occurs most in natural forest habitats in mountainous areas with canopy cover from 0.3 to 0.5 with 215 dusts, accounting for 48.8% of the dust encountered. Next is the swidden habitat with 112 bushes, accounting for 25.4%. The grassland habitat type was found 79 dust, accounting for 17.9%. Natural forest habitats with canopy cover > 0.5 found 25 dust, accounting for 5.7%. The lowest is the forest habitat on rocky mountains, mainly dust in the humid area of the rock crevice with humus, only 10 dusts, accounting for 2.3%.

The percentage of mature dust appeared most in natural forest habitats with canopy cover 0.3 - 0.5, accounting for 43.1%, followed by upland fields accounting for 11.6%, grassland 6.8%, rocky mountains 1.1% and low Most natural forest habitats with canopy cover > 0.5 have only 0.7%. This result shows that the suitable conditions for *C. javanica* to grow and develop are poor secondary forests or newly restored forests with canopy cover 0.3 - 0.5. In addition, the swidden areas, the lands outside the forest edge are also potential sites for planting *C. javanica* if the impact from herbicides and slash-and-burn farming activities can be controlled. These are very important bases for conservation and commercial cultivation of *C. javanica* in Son La.

3.2.2. Distribution of C. javanica by altitude belt

Altitude is an ecological factor that has a great influence on the distribution characteristics of each species. In the study area, the study was carried out at 5

different points of Son La. In which: Van Ho district has an altitude ranging from 750 to 1360m above sea level; Thuan Chau district is 700-1821m above sea level; Sop Cop district has an altitude of 750 - 1800m above sea level; Song Ma district has an altitude of 306 - 1819m above sea level and Moc Chau district has an altitude of 1050 - 1880m above sea level. Based on that, to find out the distribution characteristics of *C. javanica*, the study divided into 2 main high belt levels when establishing routes. The belt is ≤ 1000m high and the belt is > 1000m above sea level.

Table 03: Frequency of occurrence of *C. javanica* by altitude belt

High belt	Number of dust	Rate %
≤ 1000m	265	60.1
> 1000m	176	39.9
total	**441**	**100.0**

The results show that, *C. javanica* has a fairly wide distribution range along the high belt, at an altitude of ≤ 1000m the amount of dust appears more than 60.1%, at an altitude of > 1000m above sea level, the number of dust appearing accounts for 39.9 %. Elevation occurs from 650 to 1150 m above sea level, in places where the soil is good, humus-rich, moisture-loving but not stagnant, not waterlogged. These are important bases for the proposal of *C. javanica* conservation and development planting areas for the locality.

IV. CONCLUSION

- The average frequency of occurrence of *C. javanica* on 25 survey routes is 3.2 dust/km. In which, Moc Chau and Sop Cop districts have recorded occurrence but are extremely low (average 0.2 - 0.4 dust/km). Thuan Chau site is currently distributed the most naturally with an average frequency of 6.4 dust/km, followed by Van Ho site with 5.5 dust/km and Song Ma with 4.0 dust/km. The percentage of mature dust is low, the total number of mature dust is 279 dust/441 investigated dust, accounting for 63.3%. The rate of flowering and fruiting dust is 240/441, only 54.4%, the rate of flowering and mature dust is 240/279, accounting for 86%.

- The climbing medium is diverse from trees and shrubs, can crawl on the ground, cling to rock crevices, rarely cling to large trees.

- *C. javanica* was recorded in 5 survey habitats, of which the natural forest habitats were mountainous with canopy cover from 0.3 to 0.5 with 215 dust accounting for 48.8%, the lowest was the rocky habitat form only. accounted for 2.3%. In the forest, it will be more concentrated near the edge of the forest or the holes with lots of light. Upland areas and bare land are mainly regenerated dust.

- Elevation occurs from 650 to 1150m above sea level, mainly at the high belt ≤ 1000m, accounting for 60.1%. *C. javanica* is mainly distributed in places where the soil is good, humus-rich, moisture-loving but not stagnant, not waterlogged.

V. ACKNOWLEDGMENTS

The author would like to thank Ministry-level Scientific Research and Technology Development Project, Ministry of Education and Training of Vietnam B2019 – TTB – 03 for sponsoring this publication.

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