LR-5180
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RESEARCH ARTICLE Legume Research- An International Journal

Screening of Ricebean [*Vigna umbellata* (Thunb.) Ohwi and Ohashi] Cultivars against Pulse Beetle [*Callosobruchus chinensis* (L.)]

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10.18805/LR-5180

ABSTRACT

Background: Ricebean [*Vigna umbellata* (Thunb.) Ohwi and Ohashi] is an important food legume grown in Nagaland, India. It is a versatile underutilized pulse crop grown as a dry pulse and also used as green manure and fodder. Insect pests are one of the major constraints encountered and the pulse beetle, [*Callosobruchus chinensis* (L.)] is an important pest that causes considerable damage to *Vigna* seeds. This experiment was carried out to determine the basis of resistance among different ricebean cultivars against pulse beetle which will help in development of resistant varieties.

Methods: A laboratory experiment was conducted during January-June of 2019 and 2020 where 16 ricebean cultivars were screened against pulse beetle. The biological parameters of the pest on different cultivars were studied. Correlation between biological parameters of *C. chinensis* and physico-chemical parameters in different ricebean cultivars was studied.

Result: Significant difference was observed in terms of the biological parameters of the pest and the physico-chemical parameters of seeds. The seed size and seed index have significant correlation with the biological parameters of pulse beetle. Cultivars with higher protein and starch content were more susceptible while cultivars with higher phenol and tannin content were less susceptible. Based on the growth index, the following three cultivars *viz*., *Rhüjo, Akixi Anila* and *Manyhü Rhi* were found to be moderately resistant.

Key words: *Callosobruchus chinensis*, Growth index, Resistant, Ricebean, Screening.

INTRODUCTION

Pulses are important food crops that provide the nutritional requirements to human beings. Numerous pulse crops are grown in India under a variety of agro climatic conditions, of which the pulse crop, ricebean [*Vigna umbellata* (Thunb.) Ohwi and Ohashi] is an important food legume. Similar to other *Vigna* species, ricebean is a versatile crop that is mostly grown as a dry pulse and also used as green manure and fodder. It is an important pulse in Nagaland and is commonly referred to as '*Naga Dal*'. It is a traditional and native crop and there are many landraces of ricebean under cultivation in Nagaland (Shitiri *et al*., 2019). During 2020-21 the total production in Nagaland was 5,730 MT from an area of 4,970 ha (Anonymous, 2021).

Insect pests of both field and stored products are one of the major constraints limiting the production of pulses. Among the insect pests, [*Callosobruchus chinensis* (L.)] is the most important bruchid that causes considerable damage to *Vigna* seeds. It is estimated that infestation by *C. chinenesis* causes about 55 to 60% loss in seed weight and 45.50 to 66.30% loss in protein content (Kutbay *et al*., 2011). The damage due to this pest affects seed viability as well as the nutritive value of the seed. For the management of bruchids, conventional treatments methods have been used so far.

However, keeping the environmental aspects in mind, there is a need for ecologically sound methods like cultivating resistant varieties would be ideal and promising method too (Pradhan *et al*., 2020). The use of bruchid-resistant cultivars has considerable potential to minimize the loss in storage (Dongre *et al*., 1996). Various physical factors such as colour, shape, texture, size, *etc.* and bio-chemical composition such as protein, phenols, flavonoid, tannin, starch, fats, *etc.* influencing feeding and ovipositional responses have been studied by various workers and found that there is a substantial difference in host suitability and preference by bruchid on different varieties (Tripathi *et al*., 2015; Ghosh *et al*., 2022; Saravanan *et al*., 2023). Therefore, it is imminent to screen the cultivars and determine the factors influencing differential preference by the pest so that the information generated can be explored in resistance breeding. Keeping the above aspects in mind the present study was carried out to screen ricebean cultivars against pulse beetle, *C. chinensis*.

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How to cite this article: Kuotsu, K., Neog, P., Imtinaro, L. and Sangma, R.H.C. (2023). Screening of Ricebean [*Vigna umbellata* (Thunb.) Ohwi and Ohashi] Cultivars against Pulse Beetle [*Callosobruchus chinensis* (L.)]. Legume Research. DOI: 10.18805/LR-5180.

Submitted: 29-05-2023 **Accepted:** 28-07-2023 **Online**: 08-08-2023

MATERIALS AND METHODS

The experiment was conducted at the Department of Entomology, SAS, Nagaland University during January-June of 2019 and 2020. A total of 16 cultivars of ricebean collected from different parts of Nagaland were used for screening against pulse beetle, *C. chinensis* (Fig 1).

Screening of ricebean cultivars against *C. chinensis*

In order to screen the ricebean cultivar, 'no choice test' (Ponnusamy *et al*., 2014) was adopted by a Completely Randomized Design (CRD) with three replications. The experiment was conducted under controlled temperature of 28±2°C in BOD incubator. In a container with a perforated lid, 25 seeds of each cultivar were kept, four pairs of well-characterized, newly emerged male and female pulse beetle were released into the container and observations were recorded.

Oviposition and adult emergence

The pulse beetles were left in the containers for ten days for the purpose of oviposition. The number of eggs laid was recorded. Observations on adult emergence were recorded at a regular interval of 24 hours until no further emergence occurred for 5 consecutive days. The per cent adult emergence was calculated using the formula:

$$\text{Per cent adult emergence} = \frac{\text{Number of adult emerged}}{\text{Number of eggs laid}} \times 100$$

Development period

The time taken from the release of the insects to the first adult emergence and the number of adults emerged was recorded. The average developmental period was calculated by using the formula:

$$\text{Development period} = \frac{D1A1 + D2A2 + D3A3 + \ldots DnAn}{\text{Total number of adults emerged}}$$

Where,

D-Day at which the adults started emerging.

A-Number of adults emerged on D^{th} day.

Growth index

The growth index of the insect was determined by using the formula:

$$\text{Growth index} = \text{Log S/T} \quad \text{(Howe, 1971)}$$

Where,

S = Per cent adult emergence.

T = Average developmental period (days).

The cultivars were categorized based on the growth index as follows:

Category	Growth index
Resistant	< 0.05
Moderately resistant	0.051-0.060
Moderately susceptible	0.061-0.070
Susceptible	0.071-0.080
Highly susceptible	>0.081

Per cent infestation and weight loss

From each cultivar 100g seeds were taken and four pairs of newly emerged male and female *C. chinensis* were released and were allowed for oviposition. The containers were left alone and adult emergence was observed *i.e.* for one generation.

The per cent infestation and weight loss of seeds was calculated using the formula below:

$$\text{Per cent infestation} = \frac{\text{Number of holed seeds}}{\text{Total number of seeds}} \times 100$$

Per cent weight loss =

$$\frac{\text{Initial weight of grains - Final weight of grains}}{\text{Initial weight of grains}} \times 100$$

Evaluation of physico-chemical parameters of seed

The different physical characters and biochemical contents (Table 2 and 3) of the seeds were analysed. The seed index, size, coat thickness, shape, colour and texture of the seeds were recorded. The bio-chemical contents *viz*., protein, phenols, tannin, starch and fat contents were determined. The determination of phenol content was done by outsourcing at Indian Institute of Food Processing Technology (IIFPT), Thanjavur, Tamil Nadu. The protein content was estimated by Kjeldahl method (AOAC 1970), tannin content was estimated by Folin-Denis method (Schanderi, 1970), starch content was estimated by anthrone reagent method (Hodge and Hofreiter, 1962) and the fat content was estimated by using Soxhlet extraction method (AOAC 1970).

Statistical analysis

The data from different observations were transformed and subjected to Analysis of variance (ANOVA) and also by Duncan multiple range test (DMRT). Correlation between different biological parameters of *C. chinensis* and physico-chemical parameters of ricebean cultivars were established.

RESULTS AND DISCUSSION

Oviposition

The number of eggs laid ranged from 32.67 to 131.33 (Table 1). The cultivar *Manyhü Rhi* (32.67) was substantially less preferred for oviposition while *Sipheghonu* (131.33) was most preferred. The current study showed variation in oviposition preference on ricebean cultivars. Chakraborty *et al*. (2015) also reported variation in oviposition preference by *C. chinensis* on five pulses. The physical characteristics of the seeds as well as biochemical components may contribute to the oviposition preference of *C. chinensis* (Senthilraja and Patel, 2021; Paikaray *et al*., 2021).

Adult emergence

The adult emergence was highest in the cultivar *Sipheghonu* (73.60%) and it was the least in cultivar *Rhüjo* (58.00%) (Table 1). The reduction in adult emergence could be due to non-preference of cultivar for oviposition. The results are in conformity with the findings of Arpitha and Sagar (2011).

Fig 1: Different ricebean cultivars used in the study.

Development period

The mean duration of development of *C. chinensis* ranged from 21.60 to 33.10 days (Table 1). The shortest development period was found in *Kurhi Rhide* cultivar (21.60 days). The maximum of 33.10 days was found in *Mügo Rhi*. The difference in the pest development period may be caused by certain physico-chemical characteristics of the seed. Chakraborty *et al*. (2015) and Bharathi *et al*. (2017)

Table 1: Biological parameters of *C. chinensis* on different ricebean cultivars.

Cultivars	*Oviposition	**Adult emergence (%)	*Development period (days)	Growth index	**Infestation (%)	**Weight loss (%)
Akixi Anila	55.33^{e} (7.47)	63.25^{ab} (52.69)	30.82^{ab} (5.60)	0.058^{c} (MR)	9.27^{l} (17.73)	6.42^{fg} (14.68)
Rhüjo	33.33^{j} (5.82)	58.00^{b} (49.60)	31.11^{ab} (5.62)	0.057^{c} (MR)	7.10^{m} (15.45)	3.73^{h} (11.14)
Ashei Nyakla	48.67^{f} (7.01)	65.07^{ab} (53.77)	26.78^{ab} (5.22)	0.068^{bc} (MS)	18.74^{f} (25.65)	8.38^{cde} (16.83)
Kurhi Süre	60.33^{de} (7.80)	69.61^{ab} (56.55)	25.72^{ab} (5.12)	0.072^{abc} (S)	23.01^{e} (28.67)	7.45^{def} (15.84)
Pinchong Wethroi	38.67^{hij} (6.26)	60.34^{ab} (50.97)	26.38^{ab} (5.18)	0.067^{bc} (MS)	13.25^{hij} (21.34)	5.82^{fg} (13.96)
Kerhü	36.33^{ij} (6.07)	64.22^{ab} (53.26)	26.25^{ab} (5.17)	0.069^{bc} (MS)	15.07^{gh} (22.84)	7.14^{defg} (15.50)
Mügo Rhi	70.67^{c} (8.44)	71.70^{a} (57.86)	33.10^{a} (5.80)	0.084^{bc} (HS)	36.24^{c} (37.01)	8.85^{bcd} (17.31)
Rhüse	41.33^{ghi} (6.47)	66.13^{ab} (54.41)	26.26^{ab} (5.17)	0.069^{bc} (MS)	11.44^{jk} (19.77)	5.37^{g} (13.40)
Hera Ragei	43.67^{fgh} (6.65)	67.18^{ab} (55.05)	27.07^{ab} (5.25)	0.067^{bc} (MS)	13.80^{hi} (21.81)	6.72^{efg} (15.03)
Hera Rahau	47.67^{fg} (6.94)	67.83^{ab} (55.45)	26.74^{ab} (5.22)	0.068^{bc} (MS)	12.62^{ij} (20.81)	6.01^{fg} (14.19)
Rhüdi	74.67^{c} (8.67)	70.54^{ab} (57.12)	25.48^{ab} (5.10)	0.073^{abc} (S)	25.10^{d} (30.06)	9.49^{abc} (17.94)
Manyhü Rhi	32.67^{j} (5.76)	60.20^{ab} (50.89)	30.50^{ab} (5.57)	0.058^{c} (MR)	9.86^{kl} (18.30)	5.45^{g} (13.50)
Kurhi Rhide	118.33^{b} (10.90)	72.39^{a} (53.80)	21.60^{b} (4.70)	0.086^{a} (HS)	49.43^{b} (44.67)	10.25^{ab} (18.68)
Khueishuei Shumei	40.33^{hi} (6.39)	67.77^{ab} (55.41)	23.92^{ab} (4.94)	0.077^{ab} (S)	22.86^{e} (28.56)	6.72^{efg} (15.03)
Rhüluo	63.67^{d} (8.01)	61.26^{ab} (51.51)	26.50^{ab} (5.20)	0.067^{bc} (MS)	16.03^{g} (23.60)	7.37^{def} (15.76)
Sipheghonu	131.33^{a} (11.48)	73.60^{a} (59.08)	22.75^{ab} (4.82)	0.082^{ab} (HS)	63.67^{a} (52.93)	11.07^{a} (19.43)
SEm±	0.55	0.99	0.76	0.001	0.16	0.14

Figures in the table are mean values. MR- Moderately resistant, MS- Moderately susceptible, S- Susceptible, HS- Highly susceptible.
*Figures in the parentheses are square root transformed values.
**Figures in the parentheses are angular transformed values.
Within column values followed by different letter(s) are significantly different (P=0.05) by DMRT.

Table 2: Physical characters of seeds of local ricebean cultivars.

Cultivar	Colour	Texture	Shape	Seed coat thickness (mm)	Seed size (mm^2)	Seed index (g) (100 seed weight)
Akixi Anila	Green	Smooth	Oblong	0.070±0.002	53.11±1.43	11.97±0.016
Rhüjo	Green	Smooth	Oblong	0.091±0.011	22.87±0.96	5.28±0.008
Ashei Nyakla	Dark blue	Smooth	Nearly round	0.096±0.007	61.85±3.78	17.16±0.039
Kurhi Süre	Creamy white	Smooth	Oblong	0.068±0.002	69.50±1.44	25.06±0.020
Pinchong Wethroi	Light yellow	Smooth	Nearly round	0.103±0.011	46.17±0.61	10.86±0.019
Kerhü	Light brown	Smooth	Oblong	0.061±0.004	20.66±0.11	9.58±0.010
Mügo Rhi	Light brown with black spots	Smooth	Oblong	0.093±0.004	72.91±1.53	24.73±0.022
Rhüse	Yellowish green	Smooth	Oblong	0.086±0.006	21.34±1.02	5.33±0.012
Hera Ragei	Brown	Smooth	Oblong	0.087±0.004	22.51±1.29	5.43±0.015
Hera Rahau	Light yellow with black spots	Smooth	Oblong	0.057±0.004	19.46±0.71	5.41±0.012
Rhüdi	Light yellow with black spots	Smooth	Oblong	0.086±0.006	51.95±1.83	16.59±0.007
Manyhü Rhi	Light yellow with black spots	Smooth	Oblong	0.079±0.006	27.85±0.60	8.22±0.008
Kurhi Rhide	Brown	Smooth	Oblong	0.068±0.003	84.69±2.16	46.18±0.012
Khueishuei Shumei	Light green	Smooth	Oblong	0.073±0.006	65.29±2.34	26.45±0.012
Rhüluo	Light brown	Smooth	Oblong	0.066±0.003	40.31±0.43	10.55±0.015
Sipheghonu	Creamy white	Smooth	Oblong	0.068±0.002	118.54±2.36	47.84±0.014
SEm±				0.002	0.468	0.005

also reported similar findings in the developmental period of several pulses. The cultivars *Sipheghonu* and *Kurhi Rhide*, which were highly preferred for oviposition, showed a preference for development with less number of days. Similar finding was also reported by Khokhar and Singh (1987) in pigeonpea.

Growth index

Among the 16 cultivars, the growth index ranged from 0.057 to 0.086 (Table 1). Based on the susceptibility index the cultivars were grouped into 4 categories. The cultivars *Rhüjo, Akixi Anila* and *Manyhü Rhi* were moderately resistant; *Pinchong Wethroi, Hera Ragei, Rhüluo, Ashei Nyakla, Hera Rahau, Kerhü* and *Rhüse* were moderately susceptible; *Kürhi Süre, Rhüdi* and *Khueishuei Shumei* were susceptible and the highly susceptible cultivars were *Sipheghonu, Mügo Rhi* and *Kurhi Rhide.* Researchers frequently use the growth index to determine whether legume crops are resistant to bruchid infestation. In the present study none of the cultivars was found resistant to *C. chinensis*. The results are in tune with Tripathi *et al.* (2015) and Kavitha *et al*. (2018) who categorized pulses into resistant and susceptible varieties based on the growth index of pulse beetle.

Per cent infestation and weight loss

The per cent infestation by *C. chinensis* on different ricebean cultivars varied from 7.10 to 63.67 (Table 1). Among the cultivars, *Sipheghonu* had the highest percent infestation (63.67) and *Rhüjo* had the lowest percent infestation (7.10). The results are comparable with Khokhar and Singh (1987) who reported variation in per cent infestation by pulse beetle in pigeonpea varieties. The per cent weight loss varied from 3.73 to 11.07 (Table 1). The weight loss in cultivar *Sipheghonu* (11.07%) was highest. The minimum weight loss

Table 3: Bio-chemical contents of seeds of local ricebean cultivars.

Cultivars	Protein (%)	Fat (%)	Phenol (mg GAE/100 g)	Tannin (mg TAE/100 g)	Starch (%)
Akixi Anila	17.86^{i}	0.57^{gh}	382.02^{h}	1178.33^{b}	51.54^{ef}
Rhüjo	18.01^{hi}	0.93^{bc}	477.99^{e}	1181.67^{a}	51.11^{f}
Ashei Nyakla	17.85^{i}	0.87^{cd}	747.19^{a}	1086.23^{f}	54.89^{abcd}
Kurhi Süre	18.21^{h}	1.23^{a}	700.37^{b}	997.55^{i}	56.23^{abc}
Pinchong Wethroi	17.20^{j}	0.83^{de}	316.48^{l}	1103.21^{d}	53.23^{cdef}
Kerhü	18.55^{g}	0.99^{b}	323.50^{k}	1080.56^{g}	54.11^{bcdef}
Mügo Rhi	20.76^{b}	0.77^{ef}	288.39^{n}	944.21^{j}	56.78^{ab}
Rhüse	19.03^{f}	0.71^{f}	655.89^{c}	1160.54^{c}	52.33^{def}
Hera Ragei	18.64^{g}	0.77^{ef}	314.14^{m}	1090.38^{e}	53.87^{bcdef}
Hera Rahau	19.57^{d}	0.73^{f}	571.63^{d}	1161.23^{c}	52.56^{def}
Rhüdi	20.02^{c}	0.78^{ef}	412.45^{g}	1002.11^{h}	56.67^{ab}
Manyhü Rhi	18.22^{h}	0.74^{f}	377.34^{i}	1176.03^{b}	52.14^{def}
Kurhi Rhide	21.04^{a}	0.51^{h}	194.76^{o}	840.54^{k}	56.98^{ab}
Khueishuei Shumei	19.33^{e}	0.61^{g}	440.54^{f}	998.63^{i}	55.10^{abcd}
Rhüluo	19.01^{f}	0.99^{b}	363.29^{j}	1087.21^{f}	54.46^{bcde}
Sipheghonu	21.12^{a}	0.60^{g}	80.06^{p}	808.57^{l}	57.89^{a}
SEm±	0.02	0.008	0.008	0.008	0.218

Figures in the table are mean values.

Within column values followed by different letter(s) are significantly different (P=0.05) by DMRT.

Table 4: Correlation between physical parameters of ricebean cultivars and biological parameters of *C. chinensis.*

Parameters	Oviposition (no. of eggs)	Adult emergence (%)	Development period (days)	Growth index	Infestation (%)	Weight loss (%)	Seed coat thickness (mm)	Seed size (mm^2)	100 seed weight (g)
Oviposition (No. of eggs)	1	0.735**	-0.666**	0.728**	0.934**	0.872**	-0.281	0.831**	0.879**
Adult Emergence (%)	0.735**	1	-0.821**	0.869**	0.795**	0.811**	-0.257	.0667**	0.731**
DevelopmentPeriod (days)	-0.666**	-0.821**	1	-0.987**	-0.801**	-0.767**	0.116	-0.653**	-0.747**
Growth index	0.728**	0.869**	-0.987**	1	0.856**	0.802**	-0.132	0.716**	0.813**
Infestion (%)	0.934**	0.795**	-0.801**	0.856**	1	0.880**	-0.193	0.889**	0.945**
Weight loss (%)	0.872**	0.811**	-0.767**	0.802**	0.880**	1	-0.189	0.808**	0.820**
Seed coat thickness (mm)	-0.281	-0.257	0.116	-0.132	-0.193	-0.189	1	-0.077	-0.228
Seed size (mm^2)	0.831**	0.667**	-0.653**	0.716**	0.889**	0.808**	-0.077	1	0.939**
100 seed weight (g)	0.879**	0.731**	-0.747**	0.813**	0.945**	0.820**	-0.228	0.939**	1

*Correlation is significant at the 0.05 level (2-tailed).**Correlation is significant at the 0.01 level (2-tailed) was observed in cultivar *Rhüjo* (3.73%). Similar findings were reported by Jatav *et al*. (2022) in green gram varieties. In the present study, cultivar *Rhüjo* had exhibited the lowest infestation and weight loss. In comparison to the other cultivars, the cultivar was less preferred for oviposition, adult emergence and delayed development period (days).

Physico-chemical parameters

The seed colour of ricebean cultivars varied from green to light green to yellowish-green, dark blue to creamy white, light yellow to light yellow with black spots and brown to light brown to light brown with black spots (Fig 1; Table 2). All the cultivars had smooth texture. The shape varied from nearly round to oblong. The seed coat thickness of the cultivars varied from 0.057±0.004mm (*Hera Rahau*) to 0.103±0.011mm (*Pinchong wethroi*). The seed size varied from 118.54±2.36 mm^2 (*Sipheghonu*) to 19.46±0.71 mm^2 (*Hera Rahau*). The highest seed index was found in *Sipheghonu* (47.84±0.014 g) and the least was in *Rhüjo* (5.280.008g).

The protein content among the cultivars ranged from 17.20 (*Pinchong Wethroi*) to 21.12%. (*Sipheghonu*) (Table 3). The fat content of the cultivars varied from 0.51 (*Kurhi Rhide*) to 1.23% (*Kurhi Süre*). Phenol content showed significant variation among the cultivars. It varied from 80.06 (*Sipheghonu*) to 747.19 mgGAE/100 g (*Ashei Nyakla*). Tannin content varied from 800.57 (*Sipheghonu*) to 1181.67 mgTAE/100 g (*Rhüjo*). Starch content varied from 51.11 (*Rhüjo*) to 57.89% (*Sipheghonu*).

Correlation studies

The correlation studies (Table 4 and 5) showed that the biological parameters of the pest have a significant correlation with physico-chemical parameters of the ricebean cultivars. The present study revealed that the seed size and seed index have significant correlation with the biological parameters of pulse beetle (Table 4). The suitability of the pest increased by an increase in physical factors like seed size and seed index. The findings suggest that the larger the seed area, the greater the rate of oviposition, which results in more adult emergence leading to increased infestation and weight loss. The preference for larger seeds may be due to the availability of more space for oviposition, growth and development. Similar results were reported by Rathore and Chaturvedi (1997). In the present investigation, seed coat thickness did not show any significant correlation with biological parameters which is in conformity with Neog and Singh (2011).

The biochemical content (Table 5) such as protein and starch showed a positive significant correlation with oviposition, adult emergence, growth index, per cent infestation and per cent weight loss and a negative significant correlation with the development period. The cultivars with higher protein and starch content were highly preferred by the pest for growth and development and were highly susceptible. However, phenol and tannin content showed a negative significant correlation. Cultivars having higher

Table 5: Correlation between biochemical parameters of ricebean cultivars and biological parameters of *C. chinensis*.

Parameters	Oviposition (no. of eggs)	Adult emergence (%)	Development period (days)	Growth index	Infestation (%)	Weight loss (%)	Protein (%)	Fat (%)	Phenol (mg GAE/ 100 g)	Tannin (mg TAE/ 100 g)	Starch (%)
Oviposition (No. of eggs)	1	0.735**	-0.666**	0.728**	0.934**	0.872**	0.789**	-0.389	-0.554*	-0.870**	0.765**
Adult emergence (%)	0.735**	1	-0.821**	0.869**	0.795**	0.811**	0.818**	-0.313	-0.23	-0.816**	0.827**
Development period (days)	-0.666**	-0.821**	1	-0.987**	-0.801**	-0.767**	-0.774**	0.221	0.346	0.871**	-0.866**
Growth index	0.728**	0.869**	-0.987**	1	0.856**	0.802**	0.826**	-0.283	-0.376	-0.912**	0.884**
Infestion (%)	0.934**	0.795**	-0.801**	0.856**	1	0.880**	0.819**	-0.368	-0.567*	-0.961**	0.858**
Weight loss (%)	0.872**	0.811**	-0.767**	0.802**	0.880**	1	0.731**	-0.258	-0.438	-0.889**	0.920**
Protein (%)	0.789**	0.818**	-0.774**	0.826**	0.819**	0.731**	1	-0.469	-0.501*	-0.776**	0.708**
Fat (%)	-0.389	-0.313	0.221	-0.283	-0.368	-0.258	-0.469	1	0.469	0.247	-0.045
Phenol (mg GAE/100 g)	-0.554*	-0.23	0.346	-0.376	-0.567*	-0.438	-0.501*	0.469	1	0.526*	-0.342
Tanin (mg TAE/100 g)	-0.870**	-0.816**	0.871**	-0.912**	-0.961**	-0.889**	-0.776**	0.247	0.526*	1	-0.938**
Starch (%)	0.765**	0.827**	-0.866**	0.884**	0.858**	0.920**	0.708**	-0.045	-0.342	-0.938**	1

*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).

phenol and tannin content were less preferred by the pest and they exhibited resistance against *C. chinensis.* The findings are similar to that of Tripathi *et al*. (2013) who reported that the resistance observed in different cowpea accessions is due to biochemical factors such as protein and tannin. Kavitha *et al*. (2021) also reported a positive correlation of biological parameters with protein, sugar and moisture content and a negative correlation with phenol content.

CONCLUSION

In the present study out of the 16 ricebean cultivars screened against the pulse beetle *C. chinensis,* none of the cultivars was found resistant. However, cultivars *viz*., *Rhüjo, Akixi Anila* and *Manyhü Rhi* were found to be moderately resistant. These are potential bruchid-resistant cultivars and may be exploited in future ricebean improvement program. The physical characteristics *viz*., seed size and seed index and biochemical contents *viz*., protein, starch, phenol and tannin were found to be significantly influencing the host preference of the pest. Further investigations on biochemical content influencing the host preference can be undertaken in order to gain a better knowledge of the biochemical basis of resistance in various cultivars.

Conflict of interest: None.

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